THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XVIII. No. 425—21st YEAR.] LONDON, FEBRUARY 2, 1869. [Subscription per Ann. { 15s. in Advance / 18s. Credit } DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis by Dr. FYFE, M.D.:—
9745 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
N.B.—Ramsay's Cannel most resembles the Marquis of Lothian's Cannel, but superior as to coke.
RAMSAY'S PATENT CONDENSED COKE,
DO. GARESFIELD COKE.

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GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
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The Fire Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the works are the most extensive in the Kingdom.
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GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.
These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

PARIS EXHIBITION, 1867.
THE TESTING-HOUSE REPORTS.
The Reports prepared for the Science and Art Department, under the direction of the Lords of the Council, detail the arrangements made for testing the gas apparatus exhibited. In the testing-house erected by the Special Committee appointed to further this object a gasholder was constructed by Mr. G. Glover, being a *fac simile* of that produced and patented by him in 1860, and deposited in the Exchequer, under the provisions of the Sales of Gas Act, and British manufacturers of gas apparatus were invited by advertisement, and by direct application, to forward worthy objects for exhibition. Mr. G. Glover was, however, the only manufacturer who sent Meters to be tested. The report states that, as "Mr. Glover is a manufacturer of Dry Meters only, no opportunity presented itself of comparing their accuracy with that of Wet Meters under various circumstances, but the perfection to which that maker has brought his Meters prevents the possibility of those extravagant errors which are well known to exist where Wet Meters are used."
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COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay are promptly executed at their Works as above.
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ALMA WORKS,
WALSALL, STAFFORDSHIRE;
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GEORGE GLOVER & CO.,

Patentees of the Standard Gasometers for the Government,

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LONDON, 1862.

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HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

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AT THE

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Illustrated Price Lists on application.

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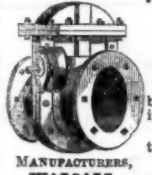

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THE

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1867.

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MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS. PRESSURE REGISTERS, &c.

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TO CORRESPONDENTS.

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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 2, 1869.

Notes upon Passing Events.

THE case of Overend and Gurney is in all the newspapers, but still there is something new to say about it. The last witness in the case on which the Lord Mayor has committed the prisoners was Mr. Edwards, an official assignee, very well known in the City. People who are not familiar with the undercurrents of the City seem surprised that such a firm as Overend and Gurney's *was* should allow £20,000 and a testimonial to be extracted from them by a gentleman whose principal business on his own account was to obtain advances for such unprofitable customers as Zachary Pearson; Xenos, the patriotic Greek; J. C. Mare, and his Millwall works; the treble bankrupt, David Lewis; John Scott Russell, and other unfortunate speculators, to the tune of three millions in bad debts. And Mr. Edwards would have the court and the public think that this was all he did for the salary of a Secretary of State. When the subject comes to be thoroughly investigated, it will probably be found that it was in his character as an official assignee, with the care of the estates of the bankrupts, in which the old firm of Overend and Gurney were deeply interested, under his charge, that Mr. Edwards' silent, if not secret, services were first found so useful. This last exposure carries back recollection to those curious cases of Davidson and Gordon, and John Windle Cole, in which Mr. David Barclay Chapman, stiffest and starchest of Quakers, figured so prominently. Perhaps the official assignee's story is not true—perhaps his treacherous memory deceives him in some particulars—but an important person confirms his more striking statement. Mr. D. B. Chapman's son, Mr. David Ward Chapman, retired from business, writes from Tours, in France, admitting he had the £5000 fresh from the till of his confiding and unconscious partners; and he drives the last nail in the coffin of the reputation of the great firm, by suggesting that the other £15,000 was a bribe to secure the silence of a man who "could have "made them put up their shutters within twenty-four hours." It must be confessed that the memory of this extra-pious man, now in retirement, will for the future be mixed up with a sort of halo of forged warrants, Confederate blockade-breaking operations, secret loans, and secret service money, of a very depressing character. As far as we can see now, the surviving partners of Overend and Gurney were, in the first instance, the victims of misplaced confidence in their partner, Chapman, and confidential agent, Edwards. A jury will have to decide whether directors can safely recommend a rotten thing to the subscribing public, even if they cheat themselves. Mr. David Ward Chapman's apology is the most amazing confession that has appeared for a very long time. He admits every charge, and sees no harm in it. In the recently published life of Bunsen we find the late King of Prussia congratulating his favourite ambassador on having married his son to a daughter of "the great Samuel Gurney." Where are the Gurneys now?

The discussion as to the site of the New Palace of Justice has assumed a new phase. Newspaper correspondence has brought new facts to bear on the debate. We have most of us been in a fog as to Sir Charles Trevelyan's plans. It is not on the Thames Embankment that he proposes to place the Palace of Justice, but on the south side of the Strand, by sweeping away all the houses between Temple Bar and King's College down to the river. Mr. Tite, who really knows what he is talking about, has come to the assistance of the disinterested ratepayers, with an inquiry that will give us facts to work on. In moving, at the Metropolitan Board, that it be referred to a committee to ascertain whether part of the surplus land on the Thames Embankment might not be available for the Probate Court, Masters, and Registrars offices. He cleared away many exaggerated notions as to the extent of land available for building on the land reclaimed from the north side of the Thames. He observed that, "at Blackfriars, "the land taken from the river was given to the gas-works. "The next piece was of very little value; but that following "it, 800 feet long, had been given to the Temple, for the "actual or imaginary damage done to them for taking their

"water frontage. They then came to a piece of land, of 150 "feet in length, which was next to Waterloo Bridge, and was "at their disposal. This was to be appropriated to a station "for the Metropolitan District Railway, for there would be no "use in having a station at Blackfriars Bridge. He then got "to Somerset House, where there was nothing to deal with; "but between Somerset House and Hungerford Bridge there "was a piece which was given to the Crown in exchange for "the foreshore of the river." This makes part of Sir Charles Trevelyan's plan very costly, but still not less worthy of consideration; although we look on his idea of transplanting Lincoln's Inn to Somerset House as a mere architect's dream. To clear away from Temple Bar, down to the river, to King's College, including Essex Street, the *Illustrated London News* printing and publishing offices, Surrey and Norfolk Streets, would be indeed grand, and place the law courts between two great thoroughfares—a river and a rail conveyance—without being subject to any noise of traffic. But it is to be feared that the cost would be more alarming than that of the extra land on the cramped Carey Street site, estimated at over half a million (£668,000). Would half a million or a million and a half buy the Strand block down to the ancient edge of the Thames? Holywell Street must be cleared away in any event, and the church of St. Mary-le-Strand must be transplanted. The objection raised to the distance that lawyers in Lincoln's Inn would have to travel to courts facing the Thames Embankment is extremely paltry, considering that all the Chancery, Appeal, Probate Court, and Common Law Bar now have to travel to Westminster, many to Guildhall and Basinghall Street, and a certain number to the Central Criminal Court. This opposition only represents the class interests of the landlords of Lincoln's Inn, Lincoln's Inn Fields, and "parts "that there adjacent lie." If the Carey Street site be given up or only partially used—and concentration may be carried too far—then there will be a new street from the Strand to Holborn. Arrangements would, no doubt, be made to turn Lincoln's Inn Fields, now chiefly after dusk a paradise of tomcats and bachelors in chambers, to a public garden. There is one mode by which the cost of the south side of the Strand site might be very much diminished, and it could be done without injuriously affecting the architectural grandeur—namely, by devoting the ground-floor, fronting the Strand and of some of the streets that must traverse the *Cité Légale*, to shops. This is done in some of the grandest blocks of buildings on the Continent, to the infinite convenience of the public. Architects may, at first, despise so commercial a notion; but as we have no tax on food and drink to fall back on, as a fund for defraying the cost of grand improvements, we must not neglect shop-rents. To use the whole frontage of the Strand as mere wall space, would be a foolish sacrifice of income much needed. Mr. Thomson Hankey, who has no special knowledge of either architecture or the accommodation required by the Palace of Justice, has favoured the *Times* with a letter, only valuable as conveying the writer's private opinion in favour of the Carey Street site, for it contains no measurements, no facts. Mr. Hankey writes in the Claphamite style, and puts his foot down on all who differ from him with characteristic and ludicrous arrogance. The opening of Parliament will, no doubt, give us, from a committee or special commission, more specific information, to which the Metropolitan Board will be able to contribute. We do not know what may be the value of land on the edge of the embankment now. The wharves near the Temple were unused and unletable before the embankment was commenced. The Temple could spare Little Bethel, and could find a better site for its library in a building that would hold its books. If the Courts of Law were on one side of the Strand, and the buildings and offices, not immediately connected with it, on the other, legal business would scarcely suffer, and the street would gain immensely. We do not understand what is said about the congestion of traffic in the Strand. We do not see it, except at the narrow gut formed by St. Mary's. The congestion begins at Temple Bar, and that a broad street to Holborn would greatly relieve. It is impossible to exaggerate the services which correspondence and discussion in the newspapers has rendered in this question. No sort of parliamentary committee or official commission can ventilate such a subject, and clear the way like a newspaper correspondence. There it is that our Government has an advantage over the scientific administration of the acutest autocrat. When the whole subject comes to be reviewed, we think it will be found that concentration of courts and offices may be carried too far, and that business will be facilitated by the multiplication of separate blocks.

The Corporation of London have also under consideration a scheme, or, rather, an idea, for consolidating their committee-rooms and offices, and rehousing their Lord Mayor and library, if they can find the money! The idea is, no doubt, right; but in practical matters execution is everything. A railroad from Notting Hill to the Commercial Docks would be a splendid assistance to the comfort and convenience of London, but the execution, in the state of the money market, presents insuperable difficulties. On the 10th of December, the Guildhall Improvement Committee presented a report, which was ordered to be printed and circulated amongst the Common Council. This report on a really grand idea shows the feebleness and uncertainty of many hands writing, altering, and correcting recommendations they very imperfectly understand. The notion of the committee is to acquire a sufficient quantity of land, to rebuild or rearrange on it all the offices connected with the Corporation, and to erect a mansion for the use of the Lord Mayor, instead of the house he now occupies in Walbrook, which would, of course, be sold, and the proceeds used towards the City Hall. The committee report that they have, including existing buildings (but excluding, we presume, the Guildhall), about two acres to deal with—an area manifestly insufficient. The—perhaps intentional—vagueness of the report crops out in section 8: "They "refused to give £45,000 for Coopers Hall, but the land they "wanted has been purchased at the price which they had "previously offered." They do not say how much. At any rate, the committee propose to erect new courts for the aldermen and the Common Council, with suitable offices and apartments. "The plan submitted would provide upwards of 250 "rooms, on the eastern side an official residence for the Lord "Mayor, which would be made to afford much greater and "more convenient and suitable accommodation than the pre-"sent Mansion House." A library and museum is also contemplated, "to form a reception-room on state occasions," at an estimated cost of £25,000; in the basement of the new courts of Aldermen and Common Councilmen, "muniment-"rooms, properly lighted and ventilated, and furnished with "suitable conveniences for the examination of the archives "and records of the Corporation." The committee recommend this great scheme of consolidation and reconstruction to a Corporation which is annually shorn of some of its powers and privileges, but still in far from a moribund condition, on the ground that "the improvements would not only be better "adapted and more convenient for conducting the business of "the Corporation, but effectually and entirely obviate the "very large expenses which are required on every public "occasion for special entertainments and otherwise, as well as "much of that incurred annually in connexion with the ban-"quet on Lord Mayor's Day." No doubt there is a certain degree of truth in the assertions contained in this extraordinary specimen of legal and Corporation English, but the array of figures given in the appendices, to support the conclusions, must be meant for show, and not for use, under the idea that a mass of figures is a sort of make-weight. For instance, what bearing can it have on the propriety of reconstructing the Mansion House, courts, and offices, that, since 1800, £36,249 8s. has been expended in fitting up the Guildhall for Lord Mayor's Days, or that special entertainments to Royal and noble personages cost £66,946 12s. 1d.? It was not bricks and mortar, plastering, and gilding, that cost £8938 13s. in 1814-16, when the Prince Regent banqueted with the citizens, or the £1149 17s. 6d. spent in preparing for William IV. in 1831, when the Duke of Wellington advised him not to trust himself to the Reform mob. Of course it is interesting to learn that, as the Corporation grows poorer and less powerful, it becomes more liberal. While in 1814 and 1816 the Prince Regent and the allied sovereigns were twice entertained for less than £9000, in 1863 the welcome to the Prince and Princess of Wales cost £11,000, and in 1867 the Sultan and the Belgians cost nearly £23,000; while Queen Victoria, in 1833, was entertained for less than £4000. We are equally puzzled to know what useful purpose is served by a long list of payments for work done and goods supplied at the Mansion House—such as £13 7s. 2d. for an eight-day clock, or £87 11s. 3d. for fixing the historical picture of "The Battle of Agincourt." Repairing plate is an annual expense, and so is cutlery—sometimes called knives

and forks; and furniture figures at from £400 to £800 a year. With all this apparent minuteness of detail, the committee have not the courage to state plainly the estimate for carrying out the plan they so warmly recommend, but put it shyly that "As to the cost of reconstruction, according to the design "now submitted by the architect, it is very difficult to make "an accurate estimate, but he is of opinion that the same may "be fairly estimated at about £5 per foot superficial." We will supply the calculation which was too much for the pluck or the arithmetical powers of the committee and their architect. If the reconstruction covers, as suggested, 90,000 superficial feet, the cost will be £450,000; say, half a million without approaches—the plan proposes a kind of *cul de sac*—and without furniture. The money would be well spent, for what Government could venture to meddle with a Corporation so magnificently lodged, and so deeply in debt? The committee conclude by asking for precautions against fire in the present buildings. Those they recommend to the notice of the Corporation, if packed as proposed in one solid block, will be exposed to total ruin if a conflagration should break out. The oddest part of the plan is, that this magnificent structure is to face one of the narrowest streets in London—Gresham Street—and with no other means of access. This would be repeating the blunder of London Bridge over again; but another half million would cure it. In a word, this is a specimen of the way in which committees of the Corporation amuse themselves, eat a number of pleasant luncheons, pass a certain number of votes of thanks, and occupy the time of the City architect or surveyor. We shall look out for the discussion on Mr. Horace Jones's dream with a good deal of interest.

We are sorry to see that the benevolent individuals who have interested themselves in forming a club for the benefit of the dressmakers and others at the West-end, who have no home on Sundays and holidays, have not been able to agree on first principles. Are male friends and relations to be allowed to call and wait in the visitors room? That is the question. Lady Portsmouth and her brother, Mr. Auberon Herbert, say no; Mrs. Westlake says yes, and has opened the club-house in Newman Street. If it succeeds it will supply one of the most urgent wants of the metropolis. What is a respectable woman to do in her spare time for rest and recreation, who lives in bare lodgings, and works most days?

The idea of reducing the number of paupers by sending them to one of our colonies has been revived by a new generation of philanthropists, who apparently know nothing of the colonizing work of the last thirty years, and nothing of the condition of our colonies and the United States. Paupers are to be found in troublesome numbers in the ports of British and Republican America, in Sydney, Melbourne, and Adelaide in Australia. When the newspapers which contain projects for shipping off British paupers to other parts beyond the sea are read, great and just will be colonial indignation. They would just as soon have convicts. The genuine pauper, accustomed to parish relief as a matter of course, is the most helpless, and therefore the most useless, of human beings. He would starve where a north country labourer or poacher would grow fat and rich. The true pauper will never work as long as there is any one within reach from whom he can beg. What can be done to relieve distress is to catch the unemployed, and ship them off in families, before they have become pauperized, to regions where unskilled labour is in demand. You will not find poor-law guardians willing to do this. Colonists like picked men and women, young, strong, unencumbered with small families, and yet likely to increase and multiply. These are just the class that employers of labour very unwillingly let go. It must be remembered that, within certain limits, paupers are useful to the employers of labour; they help to keep down wages. Those who have attempted to encourage emigration in the cotton-spinning districts, during periods of distress antecedent to the great cotton famine, know that employers of all shades of political opinion were opposed to the emigration of "hands." The old notion that raw emigrants could be successfully settled on wild waste lands has been long since exploded. Even hardy agricultural labourers find themselves at a loss when removed from the region of shops and skilled workmen. As a rule, emigrants must begin by working for wages. It will, therefore, be necessary for those who proposed to remove unemployed labourers to make arrangements for distributing them in districts where there is a demand for their services. It will not be sufficient to shovel them out on the port of a distant shore; indeed, our colonists would not submit to such an infliction. Committees, who, for instance, take in hand the case of families in the east-end of London, willing but unable to find work, must commence by establishing an efficient agency in the several British-American colonies. They must be prepared to deal with families; the idea of picking out only the best workers is quite unworkable. The assistance given to adults should be under the form of a loan. A loan will help to preserve a spirit of independence in the persons assisted, which is of the greatest importance. The word "paupers" should never be used in connexion with colonization. Finally, emigration and colonizing committees must be prepared, in defiance of the remonstrances of employers, to take the best workmen, when they can get them, mixed with the helpless members of an honest, distressed, and united family. In fact, the good must be taken with the bad; that is, the profitable with the unprofitable. Emigration, to be useful, must be conducted by families, not by units. At the same time, a good work may be done in converting the guardians of the poor to the opinion that, in the long run, it will be economy to remove the unemployed, at an early stage of distress, to countries where industry can make them independent. All our pauper schools should be made industrial schools, and the value of emigration should be conveyed in their education. Female emigrants should never be sent in masses, unless under the care of zealous and capable female guardians. All these rules for successful emigration were successfully taught by Mrs. Chisholm, but a new generation has naturally forgotten or never studied them. The colonists of New Zealand will be obliged to encourage emigration in order to out-people the native New Zealanders; but as they are very acute colonists, they are not likely to accept the sweepings of our pauperized parishes. During a previous outbreak of the natives, some ten years ago, the government of New Zealand determined to found a belt of military colonies in the disturbed districts, and, to procure colonists, sent recruiting agents to Melbourne with tempting offers of cash bounties, and from 50 to 150 acres of land. These baits soon stripped Melbourne of a large number of idle, drunken, ruined loafers; but as soon as respectable colonists and newly arrived emigrants began to enlist, the government of Victoria put such impediments in the way as effectually stopped the drain of profitable flesh and blood. However, as regards the British unemployed, the Australian and New Zealand colonies are too distant to create any appreciable stream of emigration. It is to America, British or Republican, to be reached for a few pounds, intersected by rivers and railroads, that we must look if anything on a great scale is to be done in weeding out the poor of the metropolis. All that can be done will be useless if, by better arrangements, the pauper-creating stream is not dammed at the fountain head.

We hear a great deal about the time devoted to drill by the metropolitan police; we know that some attention is paid to their literary education, and that at each remove to a higher grade a very strict examination must be passed. One subject seems entirely omitted—local geography. How seldom has a policeman the least idea of the relative distance or position of any place out of his district. In the suburbs this is especially remarkable. Ask the policeman at Harrow or Enfield the way to Tottenham or Cheshunt, and, in nine cases out of ten, he knows nothing about it. We venture to suggest that a good map of twenty miles round London should be hung up at every division and subdivision, and a periodical examination made on the subject of the best way of proceeding from and to each point of the compass. We presume that the drivers of fire-engines have this information. The same remark applies to school children. It is very seldom that the best pupil in a village school has ever seen an Ordnance map of his own county, or can tell anything about the situation of the villages he has not visited; while on the geography of the Continent of Europe and Palestine he will be full of names, latitudes, and longitudes. Benevolent patrons of schools will be glad to know that, for about a guinea, they may obtain from the publisher of the Ordnance a map of ten miles round any central house, mounted on a roller, with all the villages, woods, or coverts coloured. A few pounds would establish annual prizes for the best answers in local geography; such a competition would develop not merely memory but intelligence.

The Irish railway purchase question has arrived at a stage when it may best be left to parliamentary discussion; but as superficial people, like Lord Clanricarde, continue to abuse the

British system which has covered the world with railroads, it may be useful to see what M. Alphonse de Calonne says on the French railroad system. He is advocating what is called the fourth class of railroads. It seems that while England holds a rank second to Belgium in the length of railroads per square mile, France stands fifth in Europe, after England, Holland, and Switzerland. Up to last year, the private interests of railway companies had so far prevailed over public interests, that Boulogne-sur-Mer had not been able to obtain a direct route to Paris by a short branch to St. Omer. The round-about way, by Calais, better suited the Rothschild interest in the Great Northern. In like manner the important and distressed manufacturing town, or rather district, of Lille prayed in vain for a railroad connexion with the port of Dieppe. But the French must be very unlike the Irish, for M. de Calonne considers that nothing less than a serious grievance could induce a deputation from the Pas de Calais, to proceed, under the charge of their Prefect, to Paris, and press for a short cut by rail to the metropolis. In Ireland, any number of deputations, to ask the Imperial Government for a grant of money, may be obtained on the shortest notice, if their expenses are paid.

Circular to Gas Companies.

The announcement that the Board of Trade are actually preparing a Bill to carry into effect the main objects indicated in the parliamentary notice given on behalf of the Board in November last respecting the gas supply of the metropolis, has caused an immense sensation among all who are interested in metropolitan gas property. It had been assumed that the notice was given hastily by the late President of the Board, under the influence of misrepresentations made by a deputation, in which Mr. Beal and Mr. Dresser Rogers were the prominent personages, and that when it was found that neither the Metropolitan Board of Works nor the vestries desired further gas agitation at present, but were willing to wait to see the result of the experimental measure of last year applied to the Chartered and City Gas Companies, the notice would have been allowed to drop. So, indeed, seems to have been the intention of the late President of the Board; and his successor, soon after entering office, is represented to have stated to the chairman of the Metropolitan Board of Works that it was not his intention to promote any Bill during the present session for the regulation of the supply of gas to the metropolis. But the notices given by three of the companies of application to Parliament for large increase of their capitals, is the assigned cause of the altered intention of the Board; because it is alleged that, if the Bills promoted by those companies were passed in their proposed forms, "they would perpetuate and aggravate the "state of things which it has been the object of recent legisla-"tion to put a stop to." This renewed activity of the Board of Trade on the subject may also be owing, in no small measure, to the fact that Mr. Shaw Lefevre, who is now parliamentary secretary to the Board, was a member of Mr. Cardwell's committee, and consequently is much interested in having the recommendations of that committee carried into effect. Be that as it may, it is reported that Mr. Bright, and the other members of the Board of Trade, are so dissatisfied with the neglect of the gas companies to adopt the recommendation of the committee respecting the diminution of expenditure by amalgamation, that they have determined to give the public the benefit which it is supposed would be gained by amalgamation by fixing such a minimum of illuminating power and such a maximum of price as it is conjectured might be attained by adopting that measure. It is pointed out that two only of the thirteen metropolitan gas companies—the Chartered and the City—have adopted the recommendation to amalgamate, and that the Great Central, though occupying the same ground as those two companies, have preferred to retain their isolated position, and are promoting an independent Bill for acquiring additional powers. It appears also, from the correspondence between the Board of Trade and the Metropolitan Board of Works, inserted in another part of our present number, that it is intended to stop all further expenditure on works in thickly populated districts of the metropolis. If Parliament were to sanction such a measure as it is evidently the intention of the Board of Trade to introduce, and to use the influence of the Government to pass, it would, of course, materially depreciate the value of gas property in the metropolis; therefore he Metropolitan Board of Works are ready to support a measure, by the operation of which they might acquire possession of the several gas undertakings at a reduced price. It is this consideration, no doubt, which has induced them to depart from their previously expressed inclination to wait for the result of the experience to be gained by the experimental trial of the City of London Gas Act. Though unwilling to stir themselves in the matter, they are glad to take advantage of the proffered services of the Board of Trade, and at their meeting on Friday last they adopted the following recommendation of the Gas Committee:—

That the board do request the chairman to state to the President of the Board of Trade that, while this board would have preferred to avail themselves of the experience which may be gained from the legislation of the previous session, in reference to the supply of gas to a portion of the metropolis, before extending similar provisions to the whole of that area, yet, gathering from the letter of Mr. Shaw Lefevre that the Government are of opinion that a bill should be introduced by the Board of Trade, based upon the notice already issued by them, and having regard to the fact that three metropolitan companies are seeking authority to increase their capital and extend their works, this board are prepared to assist, by all the means at their command, in carrying a measure through Parliament for promoting the interests of the consumers of gas; and that, in the opinion of the board, no metropolitan gas company should be authorized to raise additional capital, unless on the condition of at least accepting the terms of the City of London Gas Act of 1868, as regards price and illuminating power, and that the provisions of that Act in respect of price and illuminating power should be applied to any metropolitan gas Bill brought into Parliament.

It is very remarkable that any department of the Government should be dragging along, as it were, the Metropolitan Board of Works, in a combined assault on the gas companies. The notice on which the threatened Bill is to be founded was stated at the time to be so framed as to meet all the contingencies that could be foreseen; and many parts of it are contradictory, as we pointed out at the time. We shall look with much anxiety to see what portions are retained in the provisions of the Bill.

The Bills about to be brought into Parliament for the formation of tramways in various parts of the metropolis will indirectly affect the metropolitan gas companies, by interfering with the laying down and repairing of their mains. There are three separate Bills having that object, the length of the tramways proposed being not less than 32 miles. There is, first, the Metropolitan Street Tramways Bill, for the formation of four routes on the south side of the river, diverging in various directions from Westminster Bridge Road to the Borough, Peckham, Kennington, Battersea Park, and New Southwark Street. The tramways proposed by another Bill are to extend from Upper Holloway, along Islington, to Finsbury Pavement, and from Whitechapel to Stratford. The third Bill is to authorize the making of tramways from Vauxhall Bridge Road to Kennington, Camberwell, Peckham, Deptford, and Greenwich. In all these Bills it is proposed to impose restrictions on gas and water companies as to breaking open and closing the streets. The companies are to be required to give 24 hours notice to the tramway company of their intention to break open any street, except in cases of emergency; and all works are to be executed to the reasonable satisfaction of such company. The provisions of these Bills will require to be carefully watched.

The Chartered Gas Company are proceeding in earnest with their new works at "Beckton," near Barking Creek. They have entered into a contract with Messrs. John Aird and Sons, for the erection of the buildings, tanks, landing-stage, and pier, which are estimated to cost between £250,000 and £300,000. We purpose giving a plan of these monster works in an early number, to be followed in subsequent numbers with some of the details. The same eminent firm are constructing a large gas-work, with apparatus complete, for the Brentford Gas Company, at Southall, Middlesex, where the Brentford Branch Railway joins the Great Western line; and they have also other large contracts for gas-works in hand.

We recently noticed a circular which had been issued throughout the country by the surveyor of the Leamington Local Board, extolling the merits of "a new system, which "secures a very superior light, while it effects a very im-"portant saving of expense," which was said to have been for many months in operation at Leamington. That "new system," though not explained in the circular, we stated to consist in the application of Mr. Hughes's double tap; but it seemed to be then a mystery why the surveyor should be at so much trouble to extol that contrivance. That mystery has been elucidated in a letter sent by him to the Local Board, and read at their last meeting. The double tap, whatever may be its merits or demerits, is not a self-acting instrument, but re-

quires frequent adjustments to keep it in order. Those adjustments require time, labour, skill, and attention, to produce the economical results attributed to the "system," which, it is now asserted, owes its alleged success to the surveyor's assiduous superintendence and directions, for which he requires to be remunerated. It was not, therefore, so much the merits of the double tap that he was anxious to promulgate, as his own merit in putting it into successful operation. The why and wherefore of the circular are thus made clear enough; but, inasmuch as the success of the double tap is made to depend on the skilful and constant attention paid to its adjustment, to the same degree is the value of that contrivance as an economical appliance diminished. It appears from the surveyor's letter that for 102 days during the last two years he was occupied day and night in the adjustments, "having been engaged the "whole morning at the gas-works, in setting the taps to the "proper pressures; and in the evenings, up to a late hour, "and at much inconvenience and fatigue, I have been for "hours taking the pressure out of doors from lamp to lamp." He further adds: "Night after night I have, after the day's "work was over, left my family for hours, to bring this system "into satisfactory operation." All this inconvenience, fatigue, and loss of time he is, however, willing to endure, but he suggests that the sacrifice deserves extra remuneration, and he expresses disappointment that the Board did not think of that without his suggestion. He hints, at the same time, that while he has done all the work, Mr. Hughes alone has received the reward. We quite agree with the surveyor that he is entitled to his reward; but then the question arises, after he has been properly remunerated for his restless nights and tedious mornings, what will be the amount of saving effected by the use of the double tap? It may be left to the inhabitants and visitors of Leamington to say how they have been inconvenienced by the diminished light of the street-lamps which its use has occasioned.

It sometimes happens to a man, when in a state of irritation —especially if a fit of gout be pending—that he quarrels with his best friends, attributes to them motives they never dreamed of, and then becomes prodigiously indignant at the creations of his own fancy. It is so just now with the directors of the Cambridge University and Town Gas Company. Their state of irritation is caused by the new Consumers Company; the Bill promoted by that company is the pending fit of gout; they quarrel with us, their best friends, attribute to us motives of which we had no conception, and then pour out the vials of their wrath on our imagined offences. The immediate cause of irritation is the abstract of the Consumers Bill, inserted, with those of the other gas Bills for the session, in the JOURNAL on the 19th ult., which stated that it was an allegation of the preamble that the company were formed "with a proposed "capital of £25,000, which had been subscribed and taken." The latter words were incorrect, for only a portion of the capital was alleged to have been taken; and that inadvertence has given rise to an outbreak of indignation in the local organ of the old company, for which the cause seems marvellously inadequate. On that slender pretext the proprietor of this JOURNAL is accused of collusion with "a financing Glasgow "contractor" to raise the value of the new company's shares, and a threat is held out of the exposure of such flagitious conduct to all the boards of directors of gas and water works in the kingdom. Had the directors not been blinded by the phantasies of their own imagination, they would have called to mind that throughout their whole controversy we have, from time to time, invariably condemned the intrusion into their district of a competing company; and we have not been unsparing in our remarks on the reckless squandering of money which must end in the serious loss, if not ruin, of the intruders. But the directors, in their passion, cannot recognize their best friends, who have done all they could to support them. The attack on the proprietor of this JOURNAL is, indeed, so ridiculously absurd, that it would be altogether unworthy of notice, were it not that it imputes fraudulent motives, which no honest man can help indignantly repelling, come from whatever source they may.

It appears, from the local papers, that the ratepayers of Wolverhampton are taking measures to prevent the payment, out of the rates, of the expenses incurred by the Corporation in prosecuting the late inquiry into the affairs of the Wolverhampton Gas Company. There can be little doubt they will succeed if the Corporation expenditure be strictly audited.

All persons interested in the consumption of gas will feel indebted to Dr. Odling, for the admirable and very satisfactory lecture recently delivered by him at a meeting of the Metropolitan Association of Medical Officers of Health, on the effects of the combustion of gas in dwelling-houses and public buildings. It is a very general opinion that however convenient and economical the use of gas may be, the burning of it is more or less offensive and injurious. There are frequent complaints of the heat it produces, that it blackens the ceilings, causes a feeling of closeness or oppressiveness, that it damages books, pictures, and furniture, and is injurious to health. All those objections to the use of gas were fully considered by Dr. Odling, and though they have been before often answered, they were never, perhaps, so clearly and comprehensively shown to be fallacious as in Dr. Odling's lecture, of which we insert a full report. He considered all the objections *seriatim*, commencing with the alleged heat of gas. He showed that, light for light, there is less heat produced by gas than in burning wax or sperm candles, and very much less than in burning tallow candles. He did not attach any importance to the absorption of oxygen during combustion of any kind; but, even assuming the effect to be deleterious, the burning of gas compares favourably with other illuminating agents. The smoking of ceilings by gas Dr. Odling admitted, but he attributed it rather to the concentration of the light, and to placing the burners near the ceiling, than to any greater emission of carbon during combustion. The closeness or oppressiveness of gas illumination often complained of, if it really exists, must be caused by the greater quantity of water generated by the combustion of the hydrogen, though it is doubtful whether one gas-burner, giving the light of twelve candles, would produce more moisture than twelve candles burning separately. The assumption that the quantity of carbonic acid generated by the combustion of gas is greater than that produced by the combustion of oil or candles, was shown to be a fallacy, and that the carbonic acid generated by the former is considerably less. He dismissed the ammonia product of the combustion of gas very briefly, as it is so small in quantity that it may be disregarded; and he directed his attention principally to the consideration of the sulphur impurities. Admitting that all coal gas contains a certain amount of sulphur, he proceeded to demonstrate that that quantity is so small as not to produce any injurious effects, and that it is so far neutralized by other products of combustion as to be rendered perfectly innocuous. Dr. Odling observed that, under all the conditions of the ordinary combustion of gas, it is not *sulphuric*, but *sulphurous* acid that is produced, which acid is the weakest of any with the exception of carbonic, and is corrosive only when in a concentrated form. Assuming the sulphur in gas to be 40 grains in 100 cubic feet, instead of the tolerated quantity of 20 grains, the combustion of that quantity would produce 80 grains of sulphurous acid, occupying little more than 1-15th part of a cubic foot, or equivalent to one cubic foot in 1500 feet of gas; and to produce one cubic foot of sulphurous acid would require an hour's combustion of gas from 300 burners, each consuming five feet. It was shown also that the ammonia in the atmosphere of an occupied room, arising from personal exhalations, is more than sufficient to neutralize any sulphuric acid into which the sulphurous acid might possibly be converted. In the discussion after the lecture, Dr. Letheby came forward as the advocate of the sulphuric acid hypothesis, and attempted to refute Dr. Odling's conclusions by reproducing the facts of the destruction of the books in the Athenæum and other libraries. He took the opportunity also to protest against and disclaim what he called the "ingenious perversion" of his sulphur test, exhibited by Dr. Odling, and he attributed the discrepancies in the results of experiments to the use of such imperfect instruments. Mr. Hawksley confirmed generally Dr. Odling's opinions, and with reference to the alleged smoking of ceilings by burning gas, he denied that the discoloration was occasioned by smoke. He stated that the same effect is produced by a jet of steam, which carries to the ceiling and deposits thereon the particles of dust floating in the air; and to a similar cause he attributed the darkening of ceilings by flames of gas. Alluding to the destruction of the bindings of books, he observed that there were other causes besides the combustion of gas to account for it, and he mentioned the fact that the quantity of coal burnt in London gives off 6000 tons of sulphur into the atmosphere every year. Dr. Odling also, in replying to Dr. Letheby, discredited the assertion that the books in the Athenæum library were damaged by sulphuric acid produced by the combustion of gas.

We have much satisfaction in noticing a translation into French of Dr. Schilling's "Handbuch für Steinkohlengas-"Beleuchtung," by M. E. Servier, formerly assistant engineer of the Paris Gas Company, and to whom the French public are indebted for an excellent translation of Clegg's "Treatise on Coal Gas." To English engineers the translation will be very acceptable, as this valuable German standard work on gas is now presented in a form more generally accessible than in the original language. Considering that it must, in a great measure, go over the same ground as Clegg's treatise, it is remarkable that the work contains so much new matter, presenting the same things from different points of view, frequently opening fresh fields of thought in reference to the manufacture and distribution of gas, and exhibiting, in numerous illustrations, many new contrivances and forms of apparatus. The book, which is handsomely printed, comprises 358 large quarto pages, and contains as many as 70 lithograph plates and 310 woodcuts, all of them executed in a superior manner. The illustrations of the details of the construction of gasholders are exceedingly varied, and deserving of attention, consisting of no less than 13 plates and 65 woodcuts.

Correspondence.

NOVEL SUGGESTION FOR MAKING GAS PURIFIERS PORTABLE.

SIR,—Having tested for myself the relative merits of oxide of iron and hydrate of lime as purifying agents, I have been strongly impressed with the superiority of lime over oxide of iron as a purifying medium.

In the last number of the JOURNAL you have a report by Mr. Wurtz to the directors of the Manhattan Gas Company, in which he shows that on at least four of the impurities contained in coal gas oxide of iron can have no effect, whereas they are distinctly under the control of the lime process. Both Dr. Letheby and Mr. Bowditch, if I mistake not, are of opinion that a return to the lime process is most desirable, provided the fatal objection of smell from the foul lime could be overcome.

Mr. Wurtz makes reference to a plan in operation at the Manhattan Gas-Works, which, from his report, appears to modify to some extent the noxious smell which emanates from the foul lime. It is evident, however, that the remedy is only partial, and does not altogether remove the effluvia, which, while it may not be positively injurious to health, is nevertheless most obnoxious to the olfactory nerves of the majority of mankind.

It seems to me that the most simple and effectual mode of doing away with the nuisance from the foul lime is to make the purifiers *moveable*, and transport *them* with their foul contents undisturbed to some point where they could be emptied without causing offence to any one. This could easily be effected by having a series of small purifiers, about the size of an ordinary luggage waggon (say 13 ft. by 7 ft. by 3 ft. 3 in.), mounted on small wheels, so that they could be conveniently run into position, and on to a railway waggon adapted for the purpose of transporting them to any desired point.

To secure strength combined with lightness, the body of the purifiers could be made of boiler plate.

When in action the purifiers would be arranged in parallel lines on rails, and have a foul and clean main on opposite sides. The purifiers would be connected together and to the mains by means of water-cup joints and light portable pipes. The off-takes from the mains to each purifier would be fitted with valves for turning off the gas when it was found necessary to change them. When this is to be effected the mode of action is very simple: the two valves are turned off, the bends removed, the inlet and outlet of the purifier hermetically closed; it is then ready for transportation. The partially fouled purifier is then run into the place of the one removed, and a clean one substituted, and so on throughout the range.

By this plan the nuisance of a gas-work would be reduced to a minimum; there would be no smell in the changing of the purifiers, except from the very small quantity of gas that would escape necessary to equalize the pressure, and even this might be avoided by pumping it out of the purifier into the foul main.

The above remarks apply to gas-works having direct railway communication, but the plan is equally applicable to those having water communication, or even where considerable cartage had to intervene between these modes of conveyance.

The increasing value of spent lime for agricultural purposes would, in a great measure, compensate for any extra expense that might be incurred by this mode of working, and it is the duty of gas companies, by every means in their power, to reduce the impurities in the gas to the lowest possible amount, and render their works as innocuous to their neighbours as they can possibly be made.

JOHN YOUNG.

Gas-Works, Hawick, Jan. 26, 1869.

Legal Intelligence.

COURT FOR CONSIDERATION OF CROWN CASES RESERVED.

SATURDAY, JAN. 23.

(*Before Lord Chief Justice* BOVILL *and Justices* BYLES *and* LUSH, *and Barons* CHANNELL *and* PIGOTT.)

THE QUEEN *v.* FIRTH.

The prisoner was indicted at the quarter sessions for the West Riding of Yorkshire for stealing 1000 cubic feet of gas, the property of the corporation of Halifax. It appeared that Firth was a worsted manufacturer, and it was shown that he had connected a pipe with the main, so that the gas did not go through the meter. There were 82 jets supplied in this manner, and that had been going on for eleven years. It was objected that the prisoner had not been called on to answer the case on one indictment, but that the case must go to the jury on one or more takings. This point was reserved.

Mr. MANISTY, Q.C. (with him Serjeant T. ATKINSON and Mr. FORBES), for the defendant, said they would only go for three separate takings. It was the duty of the judge to tell the prosecutor he must elect upon what days he would confine his evidence, otherwise he might indict from day to day.

The CHIEF JUSTICE said it was one continuous act for eleven years, because there was no turning off at the main.

Mr. MANISTY said the evidence showed more than three takings. The prosecutor was bound to state the days of the taking.

Mr. MAULE (with him Mr. HANNEY) was heard on the other side.

The court considered the conviction was right. Conviction affirmed.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS—FRIDAY, JAN. 29.

The Weekly Meeting of the Board was held this day, at the Offices, Spring Gardens—Sir JOHN THWAITES in the chair.

The subjoined correspondence between the Board of Trade and the chairman of this board was presented:—

Board of Trade, Jan. 5, 1869.

My dear Sir,—When you came here to represent to Mr. Bright the views of the Metropolitan Board concerning the notice with respect to gas legislation issued by directions of the late Government, it was suggested (and I believe the suggestion met with your concurrance) that the Metropolitan Board should communicate officially, and in writing, to the Board of Trade their opinion concerning gas legislation during the present session. The Board of Trade have not yet received any such communication, and I therefore take the liberty of writing to you, and of pointing out how desirable it is that the Government should be in possession of the views of your board as soon as possible.—Believe me, &c.,

(Signed) T. H. FARRER.

Sir John Thwaites, &c.

Meaburn House, Putney, Jan. 8, 1869.

My dear Sir,—Unfortunately I am laid up with severe cold and neuralgia, and unable to be at my post at the board, and I fear it may yet be some days before I am able to resume work.

When I had the honour of an interview with the president, after stating the object of my application—viz., to ascertain the views of Her Majesty's Government in reference to the notice issued by the Board of Trade in the matter of gas legislation, I stated that if the department, for the purposes of record, desired that my question should be in writing, I would send an official letter to that effect, and might receive an official reply; but at the close of the interview, I said that my object was fully answered by the statement of the president, "that it was not his intention to promote a bill during the ensuing session," to which you added, "that it had certainly not been the intention of his predecessor, the Duke of Richmond, to take that step." Learning thus that the opinions of both the former and the present presidents of the Board of Trade were adverse to immediate legislation, I stated that it would clearly be unnecessary further to trouble the department, and that I should have the honour of reporting the president's answer at once to my colleagues, who were then sitting in committee.

Future gas legislation in no degree formed the subject of conversation, neither was it alluded to either in principle or detail, being foreign to the object of my interview, which was not to communicate the board's views in reference to that subject, but simply to learn from the president what course he proposed to take under the notice issued by his predecessor.—I remain, &c.,

(Signed) J. THWAITES.

T. H. Farrer, Esq.

Board of Trade, Jan. 14, 1869.

My dear Sir,—I beg to acknowledge your note of the 8th inst., which I will communicate to Mr. Bright.

In the meantime allow me to say that according to my recollection it scarcely conveys a clear or complete impression of what passed at the interview to which it refers.

I trust that you are by this time quite recovered.—Believe me, &c.,

(Signed) T. H. FARRER.

Sir John Thwaites.

Board of Trade (*Railway Department*), *London, Jan.* 20, 1869.

Sir,—I am directed by the Board of Trade again to call the attention of the Metropolitan Board of Works to the subject of gas legislation of the metropolis.

Since the date of the notice given by the late Government, and of the letter from the Board of Trade of the 14th of November, explaining that notice, the chairman of the Metropolitan Board of Works has had an interview with the President of the Board of Trade.

At the interview the chairman expressed the surprise of his board that the Board of Trade should have given the notice in question without previous communication with the Metropolitan Board. It was explained to him that the time for giving notices fixed by the Standing Orders did not admit of such communication, and his special attention was called to the above-mentioned letter from the Board of Trade to the Metropolitan Board, which fully explained the circumstances under which the notice in question was given.

In order that no misapprehension may exist on this subject, I quote the terms of that letter—

"By the Act of last session, passed after several years of agitation and discussion, considerable alterations were made in the Metropolis Gas Act, of 1860, more especially as respects illuminating power, price, and purity. But the Act of last session applies to three only out of the thirteen companies which supply the Metropolis; so that whilst those three companies and the districts they supply are regulated by new provisions, which after long discussion Parliament has in 1868 determined to be equitable, the other ten companies and the districts which they supply remain subject to the Act of 1860. It is not to be expected that this state of things should continue, and it is for the interest of all parties that a final and complete arrangement should be made as soon as possible. Such an arrangement will require legislation, and no legislation can take place in the coming session unless the requisite parliamentary notices are given.

"Under these circumstances it has been represented to the Board of Trade that it is difficult for any of the parties interested to take the initiative, and that unless the Government give the requisite notices no opportunity will be afforded for complete and satisfactory legislation. To prevent this, and to render legislation possible, the Board of Trade have issued the accompanying notice, which is so framed as to meet all the contingencies which they are able to foresee. This is their sole object, as at present advised, and as regards their future action they reserve to themselves entire discretion.

"At the same time they will be glad at any time to forward by all the means in their power any satisfactory arrangement which the various parties interested may be able to agree upon or to suggest."

Sir J. Thwaites further stated, in the course of the interview in question, that the Metropolitan Board had, in the course of the autumn, considered the question, and had come to the conclusion that it was not desirable to attempt legislation this year; and on being asked whether this conclusion and the reasons on which it was founded had been in any way communicated to the Government, he admitted that they had not. It was then pointed out to him that it was of great importance that the Board of Trade should be placed as soon as possible in full possession of the views of the Metropolitan Board, and the President of the Board of Trade intimated to Sir J. Thwaites that if the producers and consumers of gas in the metropolis should all concur in deprecating legislation at the present time, it would not be the duty of the Government to bring in any bill upon the notice they had given.

Since that interview the Board of Trade have been expecting to receive a communication from the Metropolitan Board on the subject, but have received none.

In the meantime three of the companies which supply the metropolis have introduced bills for obtaining further capital for additional works and for other purposes. An abstract of these bills is annexed, from which it will be seen that if these bills are passed in their present form they will perpetuate and aggravate the state of things which it has been the object of recent legislation to put an end to. They adopt partially, and to some extent only, the provisions of the Act of 1868 with respect to price, power, and purity; they seek to erect or extend works for the manufacture of gas in densely crowded neighbourhoods, although one of the principal objects of the legislation of last session was to prepare for concentrating the manufacture of gas in some one or few unobjectionable localities, and by increasing the capital and plant of existing companies they will place additional obstacles in the way of that amalgamation and uniformity of management which successive committees have decided to be essential.

It is obvious that these bills materially alter the aspect of the case as presented by Sir J. Thwaites, and that they will render some action necessary on the part of those who represent the consumers. If allowed to pass in the shape in which they are deposited, they will probably aggravate the existing confusion; if simply opposed and rejected, the effect will be to prevent that extension of supply which the growth of population renders necessary, whilst, if accompanied by measures such as may afford Parliament full means of dealing with the subject, they may prove the means of extending, if not of completing the legislation of 1868.

Under these circumstances, it is obvious that the Board of Trade, while most anxious to co-operate with the Metropolitan Board, must reserve to themselves entire liberty of action.

And, in the meantime, I am to request you to move the Metropolitan Board, at their earliest convenience, to inform the Board of Trade what are the views which, under the circumstances above referred to, the Metropolitan Board entertain with respect to legislation in the ensuing session, and whether they intend to take any and what steps in the matter.—I am, &c.,

(Signed) G. Shaw Lefevre.

The Secretary, Metropolitan Board of Works.

ENCLOSURES.

South Metropolitan Gas Company.

Session, 1868-9.

Applies for power to raise £375,000 of new capital, in addition to the existing capital of £250,000, for the purpose of extending their works and increasing the supply of gas.

Dividend to be limited to 10 per cent., and insurance-fund to 1-20th of the capital. Any surplus to be applied, one-half to make up the previous year's dividend, if deficient, and one-half to be carried to next year's dividend-fund.

The Board of Trade has power to extend the application of the City Gas Act, as regards referees and auditor, to the company, but limits are placed upon the price and illuminating power different from those in the City Act.

The South Metropolitan are to supply 14-candle gas at 3s. 6d. per 1000 after Dec. 31, 1869, but there is no provision for increasing the illuminating power. Commissioners may be appointed by the Board of Trade to regulate the price and illuminating power, but within the limits of the Act of 1860.

The penalties in this bill are lower than those in the City Gas Act, 1868.

Imperial Gas Company.

Session, 1868-9.

Applies for power to raise £1,218,750 new capital, in addition to the existing capital of £2,139,250.

Also to purchase lands at West Ham, outside the company's district (defined by certain boundaries but not by acres), and to construct new works thereon, to be connected with existing works.

Also for powers to hold and work railway trucks, vessels and lighters, coal mines and collieries.

The price of gas from Jan. 1, 1869, to be 4s. per 1000 for 14-candle gas, with no provision for increasing the illuminating power.

On complaint of Metropolitan Board of Works, the Board of Trade to appoint commissioners to report on the price and illuminating power of the company's gas, which the Board of Trade may modify, within the limits of the Act of 1860, as to price, and of the present bill as to power.

Referees may also be appointed by the Board of Trade, on application from either the Metropolitan Board of Works or the company, to decide the amount of impurity to be allowed, which shall be enforced by means of the penalties contained in the Act of 1860.

Great Central Gas Consumers Company.

Session, 1868-9.

Applies for power to raise new capital to the amount of £125,000, in addition to the existing capital of £266,000, for the purpose of extending their works at Bow Common.

The bill proposes to amend the 91st section of the City Gas Act of 1868, by making the three companies liable for their share in the expenses of referees, &c., in proportion to the whole of their respective capitals, and not only on that part of it which is applicable to the City.

The Clerk read the following report from the Gas Committee:—

Spring Gardens, Jan. 25, 1869.

Your committee have to report that, in pursuance of the resolution of the board of the 22nd inst., they have considered the letter from the Board of Trade on the subject of the steps to be taken in the ensuing session of Parliament with reference to the gas supply of the metropolis. The Board of Trade call attention to the bills introduced by the Imperial Gas Company, the South Metropolitan Gas Company, and the Great Central Gas Consumers Company, for obtaining further capital, for additional works, and other purposes, and state that if these bills are passed in their present form they will perpetuate and aggravate the state of things which it has been the object of recent legislation to put an end to. The Board of Trade, therefore, think that some action is necessary on the part of those who represent the consumers. They consider that if these bills are allowed to pass in the shape in which they are deposited they will probably increase the existing confusion; if simply opposed and rejected, the effect will be to prevent that extension of supply which the growth of population renders necessary; whilst, if accompanied by measures such as may afford Parliament full means of dealing with the subject, they may prove the means of extending, if not of completing, the legislation of 1868. The Board of Trade, therefore, inquire what are the views which, under the circumstances, this board entertain with respect to legislation in the ensuing session, and whether they intend to take any and what steps in the matter.

Your committee concur in the opinion expressed by the Board of Trade as to the effects of the three different courses of action open to the board with regard to the gas companies bills which have been introduced into Parliament, and it appears to them that the third course indicated—viz., the adoption of such measures as may afford Parliament full means of dealing with the subject—is the only course which would be satisfactory to the consumers of gas in the metropolis.

The board have already decided that they will not introduce into Parliament, during the present session, any bill in relation to gas, and, of course, no preliminary proceedings having been taken, this cannot now be done. The Board of Trade have, however, with the view of rendering legislation possible in the ensuing session, given notice of the introduction of a bill, the notice being framed in such a manner as to meet all the contingencies which they were able to foresee. They, at the same time, reserve to themselves entire liberty of action. Matters being in this position, it appears to your committee that if a bill is introduced into Parliament by the Board of Trade, based upon the notice issued by them, this board should assist, by every means in their power, towards passing a measure which would ensure to the ratepayers and consumers of gas a better and purer supply of that commodity, and at a cheaper rate than that which at present exists.

Your committee accordingly recommend that the board do request the chairman to state to the President of the Board of Trade that, while this board would have preferred to avail themselves of the experience which may be gained from the legislation of the previous session, in reference to the supply of gas to a portion of the metropolis, before extending similar provisions to the whole of that area, yet, gathering from the letter of Mr. Shaw Lefevre that the Government are of opinion a bill should be introduced by the Board of Trade, based upon the notice already issued by them, and having regard to the fact that three metropolitan companies are seeking authority to increase their capital and extend their works, this board are prepared to assist, by all the means at their command, in carrying a measure through Parliament for giving practical effect to the recommendations of the select committee of the House of Commons; and that, in the opinion of the board, no metropolitan gas company should be authorized to raise additional capital, unless on the condition of at least accepting the terms of the City of London Gas Act of 1868, as regards price and illuminating power, and that the provisions of that Act in respect of price and illuminating power should be applied to any metropolitan gas bill brought into Parliament.

All which your committee beg to submit.

Mr. Newton, in moving the adoption of the report, said it would be remembered that in October last he brought forward a motion asking the board to agree to the promotion of a bill in accordance with what appeared to be the views expressed by the committee of the House of Commons on this subject. Unfortunately, however, as he thought, for the board, it was decided on that occasion not to promote any bill in the ensuing session of Parliament. The principal reason assigned by those who advocated that course was, that it would be prudent to wait the test of experience of the special legislation of 1868 in regard to the supply of gas to the City of London—whether it would be found to work as well as had been predicted in the interests of the consumers—before any fresh legislation was attempted, particularly as it was considered that the area of supply represented by this board differed materially in character from that represented by the City of London. He remembered that it was forcibly pressed upon the board that in the very compact area of the City—an area of not much more than a square mile—it might be possible to supply gas on more advantageous terms to the consumer than it would be in the area of 116 square miles comprised in the metropolis at large, and that the preliminaries necessary for an Act of Parliament were not so great with regard to the supply of the City as they must be with regard to the outer area represented by this board. The board would have had to go before Parliament with estimates for land and works, and in order to comply with the standing regulations of the House of Commons they must have secured an immense amount of engineering ability adapted to their special case, and this was considered an insuperable objection to any proceedings during the ensuing session. He said at the time that he thought the board were wrong in the course they decided upon, because it appeared to him that the select committee had thrown upon them the onus of initiating some legislation on the subject, and that some degree of odium would attach to them if they neglected to take steps in the matter. Dr. Evans, on the contrary, thought that no odium would attach to them except in the minds of two or three persons, whose opinions it would be wise rather to disregard than to consult. He (Mr. Newton), however, went further, and said he thought the Government, after the report of the select committee of the House of Commons, inferred that the board would do something, and it certainly now seemed to turn out as he had predicted. The Board of Trade very soon after the discussion to which he had referred gave the necessary parliamentary notices for the introduction of a bill affecting the gas supply of the whole of the metropolitan area. In doing so they made a communication to this board, in which they stated that they did not bind themselves to proceed upon the notice, but left themselves perfectly free in regard to future action. As time went on there was a communication made to the Board of Trade by the Gas Committee of this board, to know what the intention of the Government was, because it was felt that if any local authority was to be appointed to control the supply of gas in the metropolis outside the City area, the board itself ought to be that authority. The Gas Committee therefore requested the chairman of the board to communicate with the President of the Board of Trade, and if necessary to see him, to ascertain if possible what course of action the Government intended to take. The chairman accordingly wrote to the Duke of Richmond, and, but that a change of Government immediately afterwards took place, would have sought an interview with His Grace upon the matter. As soon, however, as the new President of the Board of Trade (Mr. Bright) was installed in his office, the chairman obtained an interview with him, and the correspondence laid before this board subsequently took place. From the notices published it was supposed that the Government had some matured scheme upon the subject, and it was felt desirable that the board should be acquainted somewhat with its details, because if any objectionable proposition was contained in it it would be easier for the board to point it out before its presentation to Parliament than afterwards. It was apparent, however, from the earlier part of the correspondence, that no definite scheme was before the Government, but the subsequent communication from the Board of Trade indicated clearly their determination to proceed with some bill in the ensuing session. It was evident, therefore, that the Metropolitan Board were placed in this position—that legislation would either proceed with them or without them; with them if they were prepared to co-operate with the Board of Trade, without them if they refused to do so. There were, as was pointed out by the correspondence, three companies going to Parliament for additional powers, and seeking for an increase of capital to the extent of £1,718,750 in the aggregate. There was, therefore, now a very material alteration in the aspect of affairs to that which was exhibited when the question was last before this board. They must in this case, he thought, concur in the opinion expressed in the correspondence, that the gas companies ought not to be allowed to impose upon the metropolis the burden of nearly £2,000,000 additional capital in a permanent form, except upon the recognition and settlement of some distinct principle as between themselves and those who represented the ratepayers and consumers. It was perfectly clear, from the tenor of the correspondence, that the Board of Trade intended to adopt the course which this board had refused to adopt—viz., to promote a competing bill, which would no doubt receive the sanction of a special committee of the House of Commons, unless the metropolitan companies consented to accept such reasonable terms as were proposed last session to the City companies. It was therefore desirable that this board, as representing the ratepayers, should express their willingness to co-operate in carrying such a measure, and the recommendation with which the Gas Committee closed their report would, he believed, enable them to do so, and yet be consistent with the resolution to which they had already come upon this subject. With that resolution the committee did not propose to interfere, but, seeing that the Board of Trade proposed to initiate legislation, they recommended the board to co-operate with the Government in the interests

of the consumers; and they further expressed their strong conviction that any additional capital which the companies might be empowered to raise ought to be accompanied with the conditions insisted upon by the House of Commons committee last year, especially those with regard to the price and illuminating power of gas. The Gas Committee placed these words in the recommendation because there were some things in the City of London Gas Act of which they did not approve, and to which they did not wish to bind themselves. By their report they wished it to be understood by the Government and the public that, so far as they could help the consumers in getting purer gas at a lower price, they were prepared to exercise their influence in doing it, while, at the same time, they expressed an opinion that they would rather have waited to see the practical result of the legislation of last session before any further steps were taken.

Mr. RICHARDSON asked whether it was to be understood that the Gas Committee approved of all the suggestions contained in the report of the select committee of the House of Commons, because the recommendations which had been read clearly pledged the board to that.

Mr. ROCHE thought it would be better, before proceeding further, to have the report of the select committee read.

Mr. CRESY accordingly read the recommendations of the select committee.

Mr. NEWTON said the recommendations might shortly be stated to contain the controlling clauses which were embodied in the City of London Gas Act as to the appointment of gas referees and examiners, and the price and illuminating power of gas to be supplied.

Mr. E. DRESSER ROGERS seconded the motion for the adoption of the report, reserving to himself the right to speak at a subsequent stage of the proceedings.

Mr. SILAS TAYLOR moved, as an amendment—"That the board having in October last, resolved that, in their opinion, it was not advisable to take measures to promote a bill in relation to gas supply during the ensuing session of Parliament, request the chairman to state to the President of the Board of Trade that this board are desirous of availing themselves of the experience which may be gained from the legislation of the previous session, in relation to the supply of gas to a portion of the metropolis, before considering so important a question." The honourable member supported his proposition in a brief speech, of which scarcely a word was audible in the gallery.

Mr. SHAW seconded the amendment. He approved of the first part of the committee's recommendation, because it admitted the desirableness of postponing further legislation till the result of the Act of last session was ascertained, and he thought the board would stultify themselves if, after the resolution come to last October, they now professed themselves ready to co-operate in promoting a bill in the present year. It would be, in his opinion, far better to leave the Government to take what steps they pleased, and not commit themselves to a course of action, the end of which they could not foresee.

Mr. BIDGOOD said there would be nothing to urge against Mr. Shaw's objection if it were in the power of the board to arrest any further proceedings. But it was quite evident they could do nothing of the sort. The Government were determined that legislation should take place in what was believed to be the interests of the ratepayers, and the board were, therefore, placed in this position—that they must either co-operate with the Government or see themselves superseded by another body, who should be charged with the duty of securing to the public a purer supply of gas at a lower price than at present. If it were possible to wait till after 1870, which was to be the trial year for the City of London Gas Act, he, for one, would be glad to do so; but the choice was not left to the board. They must either assist the Government or abrogate their functions, and admit that they were not fit to represent the ratepayers. He was one of the last in the world to desire that the board should be first grasping after the control of one thing and then of another, and he did not agree with those who thought such was the policy heretofore adopted by them. It was because one thing after another was forced upon the board that their expenditure was constantly increasing, and he could not help thinking it would be well if those members who were continually bringing the increasing expenditure of the board before their vestries were honest enough to point out that it arose from the constantly increasing action of the board for the benefit of the ratepayers.

Mr. RICHARDSON supported the motion, and called attention to several parts of the select committee's report in 1867. He believed the benefits which were granted last session to the City of London would have been extended to the whole metropolis if a competing bill had been before Parliament, but in the absence of such a bill the select committee were not able to carry out their wishes in that respect. In going now to the Government, he hoped it would be understood that the board in their recommendation embraced to a certain extent the reports of the select committees both in 1866 and 1867. With reference to the amendment, he looked upon it as an attempt to get rid of the question altogether by a side wind. The mover of it was opposed to any interference with the gas companies; he desired that nothing should be done with them, and that they should be left alone to plunder the public in any way they pleased. He (Mr. Richardson) believed, however, that the time was now come when the Metropolitan Board should be prepared to stand forward and assist the Government in this matter, so as to secure to the consumers of gas a fair and proper article at a reasonable and proper price. That was all the public asked for; but the companies maintained that it could not be done if they were to pay any dividends. The truth of the matter was, that the companies could well pay their full dividend upon the amount of capital actually required for their trade, but not upon that which had been buried in the earth in the shape of duplicate mains, when they were in competition with each other, and which were now rendered useless by the districting system. If competition had continued, the price of gas would have been reduced already; as it was the Act of 1860 had given life to the dead capitals of the companies, and the public were required to pay 10 per cent. upon them. The only fair and legitimate way of dealing with this subject was for the board to purchase the undertakings of the companies upon the basis of giving them a fair per centage upon the capital actually required to carry them on.

Mr. FREEMAN justified the course taken by the board on the previous occasion. He believed that, single-handed and without the support of the Government, they would have no chance of carrying a satisfactory bill, because of the powerful opposition of the companies. It was a different thing, however, when they were called upon to follow—not to lead; and, seeing that the Government were about to take action, and sought their co-operation, it was the duty of the board to do all in their power to obtain a settlement of the question. He suggested that the words, "giving practical effect to the recommendations of the select committee of the House of Commons," should be omitted from the recommendation in the report, and that the following words should be substituted—"promoting the interests of the gas consumers of the metropolis." This would leave the board free to pursue such a course as appeared to be advisable hereafter.

Mr. HEALEY opposed the motion, believing that it would not be for the interest of the ratepayers that the board should interfere in the matter.

Mr. DRESSER ROGERS said he was somewhat surprised to see the position of the board on the present occasion. The Government of the country, through one of its departments, had come forward, in the interests of the gas consumers, with a notice of their intention to promote a bill in Parliament to settle the question which had been so long in dispute between them and the gas companies, and, addressing themselves to the Metropolitan Board, the body elected by those who were to be benefited by the proposed legislation, expressed the opinion that they were the parties to take the management of the supply of gas under their control; and the board were now actually canvassing the question whether they would do so or not. He felt no hesitation in saying they were bound to co-operate in every way with the Government. Strongly as he felt on the subject, he could not have recommended the board to battle with the gas companies unassisted, knowing, as he did, the serious expense in which the corporation were involved in obtaining the advantages of the Act of last session. It was a matter well known that the corporation expended out of their funds nearly £20,000 to obtain that Act, while the companies spent considerably more in opposing it, which expense, unfortunately, would ultimately come out of the pockets of the gas consumers. Although the result of the labours of the corporation was not all that could be desired, it was gratifying to know that, in the judgment of some of the most eminent engineers outside the gas companies, the saving to the City of London by the Act of last session would be during the first year, if properly carried out, no less than £40,000, and that in 1870 it would amount to £70,000. If, however, only one-half of the estimated saving was effected, the money of the corporation would not have been badly spent. The members of the board knew perfectly well that Acts of Parliament, when passed, were not always what their promoters desired to see them, for by the jugglery of those who managed the clauses, they could be so settled as almost to nullify the effect intended to be produced. Yet he was bold to say most distinctly that, in this case, the advantages were strongly in favour of the consumers of gas in the City of London, and if nothing more had been done, a great principle had been laid down as the guide for future legislation. The mover of the amendment had warned the board of the large outlay which would be necessary for the purchase of the undertakings of the metropolitan gas companies, but if he had carefully looked at the subject with a desire to work it out thoroughly, he would have found that it was no question of expense at all. There was no necessity for the expenditure of a single shilling of the money of the ratepayers. The very next day after obtaining possession of the works the board would have an income from the gas-rents, which would pay the interest on the investment. He had been charged with a desire, in carrying out such a scheme, to rob the widows and orphans whose money was invested in these works; but he denied that such was the intention, or that such would be the effect produced. He advocated that they should be paid, and paid properly; all he urged was that it should be done quickly, and that the consumers should as early as possible get the advantages to which they were entitled. After referring to the condition of gas supply in Manchester, and other places where the works were in the hands of the local authorities, the honourable member concluded by saying that though he could go much further than the resolution, he joined most heartily in supporting it.

Mr. BRUSHFIELD replied to some of Mr. Rogers's statements, and urged upon the board the propriety of adhering to the course they had already resolved on.

Mr. FOWLER justified the vote he was about to give in favour of the resolution by the altered circumstances in which the board were placed, and expressed an opinion that if they declined to co-operate with the Government some other body would be called in to take the control of the gas supply of the metropolis, from which he predicted that the last state of the ratepayers would be worse than the first.

Mr. NEWTON, in reply, accepted the suggestion of Mr. Freeman. He said he could quite understand the course taken by the members for St. Pancras in regard to the amendment, as he found, from the JOURNAL OF GAS LIGHTING, that the vestry they represented had special views of their own on the subject. In a recent number of the JOURNAL there was a paragraph to this effect—"It may be some consolation to Mr. Beal to know that, although his own vestry of St. James's have rejected his propositions for localizing the supply of gas, his notions have met with support in the less aristocratic district of St. Pancras, to which he may be inclined to retreat. At a recent meeting of that vestry, a resolution was adopted unanimously to the effect that a representation should be made to the Board of Trade that, in the opinion of the delegates appointed by that vestry on the gas question, 'whilst it is desirable to give the powers included in the parliamentary notice for the Metropolis Gas Act Amendment Bill to the vestries and district boards separately or conjointly, it is not desirable to confer the same powers on the Metropolitan Board of Works; and they respectfully urge that the bill to be drafted may be so varied.'"

Mr. HEALEY: Every word is true.

Mr. NEWTON said the article from which he was quoting thus continued—"It is evident that the far-seeing vestrymen dare not trust the Metropolitan Board of Works with the manufacture and the supply of gas, and that they want to have the management and patronage it may bring in their own hands. It would be an evil day to the gas consumers, and to the ratepayers also, were the gas supply of the metropolis by any mischance to be managed, or rather mismanaged, by vestries and district boards."

Mr. HEALEY: Or by this board either.

Mr. NEWTON said he regretted that, in the course of the debate, some harsh words had been used. He should very much have preferred that Mr. Richardson had not spoken of the gas companies as "plundering the public," and that Mr. Rogers had not used the word "jugglery." It was the first time he had ever heard such a reflection cast upon the House of Commons in that board.

The CHAIRMAN said he did not understand Mr. Rogers to apply the term to the members of the House, but to parties who appeared before committees in the arrangement of clauses.

After some further remarks, the amendment was put and negatived.

The motion, altered as suggested by Mr. Freeman, was put and carried.

Mr. ROCHE, as a matter of form, suggested that the communication to the Board of Trade should be made through the clerk of this board, and not through the chairman, which was agreed to.

PETROLEUM GAS.—A concession has been granted for lighting with petroleum gas the small town of Seraign, near Liège, in Belgium, the seat of the great engine-building and iron-making establishments of John Cockrell and Co.

DR. ODLING ON THE COMBUSTION OF GAS IN HOUSES.

At a recent meeting of the Metropolitan Association of Medical Officers of Health, held in the Scottish Hospital, Crane Court, Fleet Street—Dr. DRUITT in the chair,

Dr. ODLING (after apologizing for the previous postponement of his lecture in consequence of indisposition) said: Any one who chances to occupy a position similar to that in which I now stand, may do so for one of two principal reasons—either that he himself feels he has something of importance to say, or that other people think he ought to find something to say; and I need scarcely observe that any one standing in this latter position has a very much better claim upon your forbearance than has one who comes forward himself with the idea that he has something of importance to communicate. For myself, I must say that my coming before you this evening is due entirely to the fact that your indefatigable secretary, Dr. Vinen, would not be denied. It was of no use for me to plead poverty of material; he would insist upon my obligation to find material, and the result is that I now come before you rather willing to expose to you my poverty in this particular, than allow you to imagine that there is on my part any want of interest in the affairs of the association, or any unwillingness to oblige those with whom for many years I was associated. At the same time I feel that some apology is all the more due from me, because what I have to say to you this evening is of far less importance than the matter which has had to be somewhat summarily closed in order to make room for it. I hope, therefore, I shall experience your indulgence in regard to what I propose to bring before you this evening. I am about to make some observations upon the combustion of gas in houses, and more particularly in dwelling-rooms and bed-rooms. At the present time, as is well-known, gas is largely employed in rooms in which people sit for a short time, but there is a strong objection to having it in rooms where people remain for any length of time, and a still greater objection on the part of some persons to having it in their bed-rooms. Whether the use of gas in bed-rooms is prejudicial to health or not is a matter of observation, as are, indeed, most medical matters; I do not mean a matter of prejudice or jumping to conclusions, but that, in all cases, medical opinion must be based upon the actual results of observation. All that I have to bring before you are *a priori* considerations in connexion with the subject, and I think that upon a little consideration of these points *seriatim*, it will appear that, *primâ facie* at any rate, there is no objection to the use of gas in rooms—in dwelling-rooms or bed-rooms—subject, of course, to the consideration I have already suggested; because we are unacquainted as to what the exact nature of many of the products of gas combustion is, and we are, moreover, not sufficiently acquainted with the influence on the human body of those products with whose exact nature we are more familiar. Of course, if it could be established that the use of gas is not unwholesome, its advantage in bed-rooms is obvious. By its means in the cold weather, when the aged and young suffer so much, the temperature can be kept moderate, besides the convenience of keeping food at a proper heat, and other such considerations. At the same time we cannot conceal from ourselves that the complaints of persons using rooms in which gas is burning are continuous from one time to another, and almost universal in extent. Wherever gas is burnt there are complaints, and at whatever time gas is burnt there are complaints. These complaints have reference to the heat, to the dirtiness, to the fouling of the atmosphere, to its closeness or oppressiveness—and not unfrequently something even further than this is complained of, not very definitely, but in forms of language practically synonymous. Some people say it feels sulphurous—that they can taste the sulphur; so that, in addition to the sense of closeness and oppressiveness, there is a feeling of irritation or chokiness in reference to the use of gas in rooms, not unfrequently complained of. I wish to consider some of these points. In the first instance, I would observe that we burn gas essentially for the sake of the light which it produces, and therefore that, in comparing gas with other sources of light—as candles or oil lamps—it is proper to take light for light, and to say that the light of 12 candles produced by candles, gas, or oil, gives rise to so much heat or so much contamination; because, although the use of gas for heating purposes is largely and daily on the increase, yet in the majority of instances we find that where any considerable quantity of gas is used for heating purposes the products of combustion are carried away, and that where merely a small jet of gas is used for heating purposes, as for keeping a vessel of water or food hot, the amount of gas burnt is so inconsiderable as not to have any appreciable influence upon the atmosphere of the room.

Then as to the use of gas for purposes of illumination. Great complaint is made that it gives rise to so much heat—makes the room so exceedingly hot. In reference to this and other points we shall hereafter consider, I would first of all observe upon the amount of illumination to which rooms are habitually subjected by gas, as compared with the illumination to which they are subjected by candles alone. Suppose any one of us sits in a small room—a study—which happens to be fitted with gas. We cannot have less than one burner light, which will probably burn 3 cubic feet of gas an hour, and give an illuminating power on an average equal to six or eight or more candles. Therefore we get a very much larger quantity of light even upon that most economical scale, lighting the room with but one small burner, than if we employed candles, where probably we should not use more than a couple. Accordingly we have to regard the large amount of gas which is used when we institute a comparison. For instance, in this room we have five gas-burners. If we assume that each of these is burning 3 feet an hour, and giving the light of eight candles, we have an illumination of about 40 candles in the room; and yet that is not sufficient, you see, because we are obliged, in order to satisfy our wants, to increase the supply of light by having three candles in addition. Now, if this room were lighted by candles alone, we should not put anything like 40 candles in it. That is a point to be borne in mind throughout, that the amount of illumination of a room by gas is habitually eight, or ten, or twenty times as great as it would be if some other and more expensive form of light was alone resorted to. Now, when we come to estimate the amount of heat produced by gas, we have facts to go upon which are capable of being ascertained with certainty, and have been ascertained. Different observers differ somewhat as to the exact proportions, but in the general result all observers are agreed. I will give you here the numbers taken from Dr. Letheby's experiments, which agree sufficiently, though not, as I have said, exactly, with those of other observers. For the same amount of illumination—an illumination equal to that of 12 sperm candles—we find, on Dr. Letheby's authority, that common gas will raise 279 lbs. of water 100°; cannel gas will raise only 195 lbs., and sperm oil, 233 lbs.; the oil, therefore, occupying an intermediate position as regards heating power, light for light, between cannel gas and ordinary gas. Now, when you come to solid substances, you will find that, light for light, the amount of heating produced by candles far exceeds that by even the common gas, for whereas the heating power of common gas may be expressed by the number 279, that of paraffin candles must be expressed by 362, sperm candles by 353, and wax candles by 383. When we come to tallow candles, we find the number rises very considerably, and, light for light, we have a heating power in tallow candles which is expressed by the number 505. Then I put this as a proposition about which there is no room for argument, since it is a statement of ascertained facts and experiments, and is, moreover, in accordance with what might have been predicated from knowing the conditions under which candles, on the one hand, and gas, on the other hand, is burnt—that it may be taken, I say, as an ascertained fact that the heating power of gas, as compared with that of candles, light for light, is very considerably less; somewhat in the proportion of 280 to 360, speaking on a rough average. So much, then, for the sensation of heat.

Now with regard to fouling the atmosphere. The fouling of the atmosphere may be regarded, in the first instance, as to what the burning substance takes away from the atmosphere, and then as to what the burning substance introduces into the atmosphere. First, as regards what the combustion takes away from the atmosphere, that is, of course, the oxygen. It is hardly worth while, however, to trouble ourselves in this regard, for the amount of oxygen existing in the atmosphere is so abundant, it exceeds so largely the demand made upon it—the supply is provided with such generosity—that whether any particular combustible consumes more or less oxygen is a matter of no importance whatever. The proportion removed, in any case, is so small as to make no substantial difference in the composition of the atmosphere. As a matter of fact, however, and of actual experiment, we find that just as coal gas, for an equal amount of light, gives out less heat than do candles, so in the same way, for the same amount of light, it absorbs an appreciably less proportion of oxygen. But I do not think gas can claim any great merit on this account; since even the amount of oxygen absorbed by the most highly absorbent combustible—as candles—is a matter of no consideration whatever. As a matter of fact, however, the proportions run somewhat in this way, still taking the light of 12 candles. If you represent the removal of oxygen from the atmosphere by common gas by the number 5·5, that removed for the same amount of light by ordinary solid composites, such as paraffin, stearine, wax, and sperm candles, will be represented by the numbers 7, 8, and 9. With regard to tallow candles, the number comes higher—it comes to 10. At the same time, for all practical purposes, the amount of oxygen consumed is a matter of perfect indifference.

Now we pass on to consider the additions to the atmosphere. We come, first, to the question of dirt. It is a matter of observation, in rooms lighted by gas, that the ceilings get dirty more quickly than when other modes of illumination are resorted to. If we consider, in the first place, the composition of gas as compared with the composition of candles, leaving out for the present the minor constituents—those which constitute impurities in the gas—having regard only to those more important constituents of candles and gas, they may be considered as carbon and hydrogen; and, when those two substances are completely burnt, they give rise only to the vapour of water and carbonic acid gas; so that in neither case, if the combustion is perfect, should we get any dirtiness from one or the other. Any dirtiness is due entirely to an imperfect combustion—to the fact that a portion of the carbon is not burnt into carbonic acid gas, but is discharged in the unconsumed state. In reference to the question of dirtiness, the gas manager or maker is placed in a somewhat awkward position, because, the more highly carbonaceous the gas that he sends out, the greater is its illuminating power, foot for foot, and the Act of Parliament requiring that gas should be of such an illuminating power per foot—that the light of 5 feet of gas should equal the light of so many candles. Accordingly, the richer the gas—that is to say, the more carbon there is in the gas—the higher the illuminating power, and the greater is the tendency to form soot and produce dirt. I am sure every one of us must have met with the difficulty of people saying, "I am satisfied my gas is very foul; the companies have not properly purified it; it is very dirty, it dirts the room so." That is the sort of observation every one must have experienced. But, when the gas is tested by order of the same body of men, they complain, "We do not get the illuminating power for our money that we are entitled to." But, if you get the illuminating power for the money, you run the risk of scotiness; and, if you do not get that scotiness, you are not satisfied with the illuminating power. Through this difficulty the gas manager feels constantly that he is on the horns of a dilemma. When I speak of the richness of gas in charcoal or carbon, of course I speak relatively to the amount of air supplied to the gas. If you take very rich gas, and supply it with a sufficient amount of air, you get no scotiness; if you take a very poor gas, and supply it with a limited quantity of air, you get scotiness; so that dirtiness has not so much relation to the amount of carbon in the gas as to the relative quantity of air in which it is consumed. There are two ways of burning gas for the purpose of illumination, which I had hoped to exemplify to you to-night in a much more striking way than I shall be able to do. The fact is, my assistant contrived to have a breakage coming along, and I am obliged to put up with a makeshift. Here you have one of Leslie's burners, and another of Sugg's. Although these are not the proper glasses, you will notice there is very considerable difference in the colour of the flame. You will observe that this flame is decidedly of a whiter and I think more agreeable colour than the other. In this the gas is overburnt, whereas in the other case it is, if anything, underburnt, and you consequently get a flame of a richer and yellower colour. If I overburn this gas a little more, its luminosity will almost disappear; and if I underburn the other gas a little more, it will begin to smoke, as you perceive. Here, where the gas is overburnt, we do not sacrifice the quality of light, for that we rather improve, but we overburn it to the sacrifice of the quantity. Every one, regardless of cost, has an opportunity of burning gas in this manner, if they desire to have a white smokeless light. But where you want to get the largest light at the smallest cost you get a yellow flame, and, at any rate, run the risk of scotiness. Of course the most economical plan is just that on which the gas is not so overburnt as to diminish the light, and not so underburnt as to leave any carbon unconsumed. But economy is certainly in favour of the mode of burning in which you run a risk of soot rather than in that where you run a risk of overburning.

Now, with regard to the cause of scotiness, it depends upon the access of air. Where the air is limited, the hydrogen takes up the supply of air preferentially, and the carbon is accordingly deposited more or less in the form of soot. Now, in comparing the effects of candles with the effect of gas, it is obvious to any one that the amount of unconsumed material in the case of candles is very much greater than that in the case of gas. This burner is giving the light, probably, of ten candles. If you had ten candles placed in a row, the amount of soot or unconsumed carbon would be actually greater than the amount of soot produced by this burner. The chief reasons, I think, why the amount of dirt from gas is so complained of, are, first, on account of the large quantity of gas that is burnt; secondly, on account of its being burnt in a mass, whereas, when we have a large number of candles, they are spread about different portions of the room, whereby there is no strong current from them to the ceiling; and, lastly, because the gas-burner is very commonly put much closer to the ceiling than any candle would be. Now, I cannot make the statement in a numerical form, as being ascertained with arithmetical certainty, that, light for light, there is a greater amount of dirt from candles than from gas; but I think the fact is, nevertheless, unquestionable.

That candles do not dirt the ceiling to the same extent as gas, is equally undeniable; but then gas is usually burnt nearer to the ceiling, and there is a greater consumption of material going on at a particular spot.

In comparing the amount of soot produced by a gas-burner burning its best, with an Argand oil-lamp burning its best, I dare say in that case the comparison would be unfavourable to the gas, because the gas is more liable to currents of air, and its combustion is rarely so perfect as that of a lamp, in which the flame is more sheltered.

Now we come to the question of the closeness, the oppressiveness, and the acridity which are complained of, and how far these are due to the products of the combustion of gas. First of all, with regard to the sense of closeness. This is probably due in very great measure, putting aside the question of the large consumption of gas, to the humidity of the atmosphere. Now, the humidity of the atmosphere is a relative term. We speak of the air as being more or less in close approximation to saturation—saturation not being a definite quantity, but a quantity which varies with the temperature; so that, if you have a certain amount of water in cold weather, the saturation is different from that which you have with the same amount of water in hot weather. I take it the oppressiveness complained of depends upon the air becoming so saturated with moisture that the perspiration is not taken up freely from our bodies. Under the ordinary conditions of consumption, it is probable that, light for light, gas produces a greater amount of water than other combustibles, and consequently that the atmosphere of a gas-lighted room is liable to become more saturated. What are the exact differences of amount I cannot tell you; I do not know that they have been correctly ascertained, and I am not prepared to say that they are very important or otherwise. I should be inclined to think they are not very important; but it is probable that for an equal quantity of light, gas produces a greater amount of water than candles, although I question whether it produces any much greater quantity; because, in reference to candles, we must take into consideration that the light is spread out in small quantities, and that, to get a maximum proportion of light, it is important to have the combustion concentrated as in a large gas-burner. I have no figures, then, which show the amount of water produced by candles and gas respectively for the same amount of light. To judge from the chemical composition of the two substances, we should expect that, light for light, the gas would give out more moisture than candles, and certainly it would if gas were burnt in the same way as candles are burnt, so that each particular jet should give about the light of one candle. Under those circumstances, it is certain that gas would give a greater amount of moisture than a candle; but it is somewhat doubtful whether one gas-burner, giving the light of 12 candles, would produce much more moisture than the 12 candles burning separately.

Now, with regard to the amount of carbonic acid gas produced by gas combustion, we know that the purest atmosphere in the world contains carbonic acid gas, which is, indeed, a most valuable and essential constituent of the atmosphere. We know, at the same time, that when the carbonic acid gas rises up to a point of excess, it becomes dangerous and even fatal. At what point the proportion of carbonic gas in the air becomes hurtful, is a matter on which different opinions have been expressed; but all are agreed in this respect, that the proportion may increase to such an extent as to be injurious, and we know, by experiment, that it may increase so as to be absolutely fatal. This is one of those cases in which the presence of a small amount of a particular substance is not only not poisonous, but wholesome and necessary. It is only when certain limits are passed that the poisonous action becomes at all developed. The amount of carbonic gas existing in the air ordinarily is this—100 cubic feet of air or 100 parts by volume of air contain ·04 part. That is about the average proportion of carbonic acid in the air of the open sea and downs. As regards the proportions of carbonic gas furnished by gas and candles respectively, we have well-ascertained facts, and we find in this case, as in the case of heat, that, light for light, candles impart to the atmosphere a larger amount of carbonic acid gas than does ordinary coal gas, and the proportions are in this way:—If you express the amount of carbonic acid added to the atmosphere by a gas consumption giving the light of 12 candles by the number 3, then if you take a corresponding consumption of spermaceti and paraffin and stearine candles, the addition of carbonic gas will be expressed by the numbers 5, 6, and 7.

Now as to the amount of carbonic acid which has been observed in continuously and highly illuminated rooms. These matters were made the subject of inquiry, some years ago, by Dr. Roscoe, of Manchester, but there is only one of his experiments to which I wish particularly to call attention, and it is this: an experiment was made in the gallery of the Princess's Theatre, during a crowded performance under Mr. Charles Kean's management. If any of you have ever, by choice or accident, wandered into the gallery of a crowded theatre, you will know that the sensation there is not at all pleasant, and that if a sense of oppressiveness in the air is to be met with anywhere, it is to be met with there. Now, what was the maximum amount of carbonic acid gas found in the atmosphere by Dr. Roscoe? It amounted to ·32 per cent.—that is to say, 100 cubic feet of air which, on the open downs, would contain ·04 per cent., contained in that case about eight times that proportion. At the same time you will observe that this amount falls considerably short of one-half per cent., constituting even less than a third per cent. of the entire volume of the air; but you must not forget that the whole of this carbonic acid gas was not furnished by the gaslights, for every one of the persons present contributed his share.

Now, I have spoken hitherto of water and carbonic acid gas alone as products of the combustion of pure gas; I am leaving out of consideration the impurities altogether for the present. But it must be remembered that in no gas-burner whatever do we get a perfect combustion—that in no burner do we convert the whole of the hydrogen into water, and the whole of the carbon into carbonic acid. In every case there are intermediate products formed and discharged; there are certain proportions of unburnt gas, or, rather, I should say, incompletely burnt gas. Of course, when a burner is turned on to such a height as to produce smokiness, we know that the gas does not get its full supply of oxygen, and that a portion of the carbon remains unburnt and constitutes soot. You will notice that where a rich cannel gas, like the more expensive London gas, is being burnt, unless you have a burner which largely supplies it with air, it has a decided tendency not only to smoke, but also to smell, as the result of its being incompletely burnt. So far as these intermediate products are concerned, which result from an underburning of gas, I do not think that gas is in any worse position than candles. You do not ordinarily smell candles to the same extent, indeed, and for this reason, because they are not burnt in anything like such large quantities; but, if you have occasion to burn a candle in such a manner as to stand over it for a minute, you get the smell of the unburnt products very disagreeably, and can even tell the composition of the candle by the smell which it gives out in burning. I cannot give a numerical comparison; I can only give you a statement of the general fact, that in both cases there is a considerable quantity of material unburnt, through a deficient supply or an ill-directed supply of air; but, while all are agreed that, with a deficient supply of air, you cannot get perfect combustion, many seem to think that, where you have an excess of air, there you must get perfect combustion. This is very far from being true. In the chemical laboratory we know it as a matter of constant practice. When we want to estimate the products of combustion or the products of oxidation, which is the same thing, we are never satisfied with burning any substance whatever in a current of air, but are always obliged to pass the products of combustion, together with the excess of air, over some red-hot material, in order that the excess of air may act upon the products of the original imperfect combustion. We know, first of all, as a matter of fact, that it is so; and we know, also, as a matter of philosophy, that it must be so. In every luminous flame there is an intermediate portion which gives you the highest luminosity. But the combustion is not complete in that layer. In the exterior layer you have still some unburnt gas, which is, however, mixed with several things which interfere with its complete burning. Thus it is mixed up with the products of combustion of the intermediate layer and its deoxygenated air, as well as with an excessive proportion of the external air. In such a mixture the really combustible gas is no longer in a condition to burn. Even if you take ordinary coal gas, and mix it with a sufficient excess of air, it no longer burns, or burns but very partially. That gas may be burnt with a large excess of air and yet not be completely burnt, is a fact which must have been within the experience of all of us. You may very likely have employed for different heating purposes, at times, burners with a very large amount of metal. There were some cast-iron burners introduced a few years ago, the gas from which burnt with a pale blue non-luminous over-aërated flame, and at the same time every one must have appreciated the very disagreeable smell which resulted from the incompletely burnt products of an acid character which these burners yielded. Here is a flame which is giving, you will say, no light at all—it would hardly do to enable you to see your watch by if there were no other light in the room, even on bringing the watch to it. This jet is burning with an excess of air, and the products of the combustion are being condensed in the Letheby cylinder. If we examine the condensed water by dipping into it a piece of test-paper, we find it has a very strongly acid reaction. Of course, this of itself does not account for much in illustration of the point I am bringing before you, because this acidity may be due to sulphurous acid resulting from the combustion of the sulphur of the gas, or it may be due to nitric acid resulting from the combustion of the ammonia of the gas; but if you take this liquid and neutralize it with baryta, and expose the neutralized solution to the air, the whole of the sulphurous acid will become converted to sulphate of baryta, and so be removed from the solution. But the solution still contains some baryta in combination with an organic acid, so that when evaporated down it leaves a residue, which is converted by ignition into carbonate of baryta. There is no doubt whatever that in burning gas, or in burning any combustible with an excessive supply of air, so as to cool down the flame beyond the temperature at which it burns at its best, you do get oxidized products formed which are not carbonic acid or water, but something intermediate between these products and the original combustible; and some have gone so far as to call this something lampic acid. You must bear in mind that the sensation of smell in an artificially lighted room, and much of the sensation of oppressiveness, depend upon the fact not that there is too much water, or that there is too much carbonic acid introduced into the room, but that the room is saturated with the strong-smelling products of an imperfect combustion. Making a comparison between gas and candles, as regards the products of imperfect combustion, we have no satisfactory data. The only point to be borne in mind is that the combustion of gas is carried on much more freely, but whether, light for light, you would get a larger amount of unburnt products in the one case or the other, is a matter which has not been to my knowledge ascertained.

Now we come to the subject of the combustion of the impurities of coal gas. I suppose I must say that all coal gas contains some ammonia—that is to say, it contains some chemically speaking; so that, if it were required to recognize it, ammonia might be detected in any coal gas whatsoever. The greater part of the coal gas supplied in London, however, contains but a very small portion of ammonia. The Act of Parliament requires that coal gas should be so free from ammonia as not to affect turmeric paper, and ordinarily the gas in London either does not or only just does affect turmeric paper. When we bear in mind the extreme delicacy of this test—I think it has been calculated that one grain of ammonia in 100 cubic feet of gas will affect the test-paper decidedly—you may infer that the ammonia in ordinary gas, where it does not or does only just affect the test-paper, is so small as to allow of its being disregarded. At the same time, where the ammonia does exist in any quantity it is certainly objectionable. There is no doubt that by its combustion it produces a certain amount of nitric acid, which is prejudicial in many ways, and that the ammonia itself is prejudicial to the brass taps and fittings.

So much, then, with regard to the ammonia as existing in coal gas; and now to consider the sulphur. As all gas contains ammonia, so all gas contains sulphur in greater or less proportion. When this sulphur burns it gets converted into what is termed sulphurous acid, and when this sulphurous acid is exposed for a sufficient length of time to the air it takes up more oxygen, and gets converted into sulphuric acid, which, in a concentrated form, is known as oil of vitriol. But no matter under what circumstances you burn sulphur, it does not burn directly into sulphuric acid—it only burns into sulphurous acid. No matter at what temperature you burn the gas, you get sulphurous acid produced, and not sulphuric; but when this sulphurous acid is exposed to the air and to moisture, under these circumstances it absorbs oxygen, and gets converted into sulphuric acid, and it is possible that, under certain circumstances, supposing the sulphuric acid to be so formed, it might get to a reasonable degree of concentration.

One word as to the character of this sulphurous acid. It is a substance which, in a concentrated state, is very irritating. Now-a-days we do not meet with sulphur matches, they are generally tipped with paraffin, though most of us know the irritating effect upon the nose of sulphurous acid; but, though very irritating, it is not at all corrosive. As medical men, we all understand the difference, that such a thing as cantharides or snuff, for instance, is extremely irritating, but yet not corrosive. Just so with sulphurous acid. Chemically speaking, it is one of the weakest acids with which we are acquainted, and corresponds, in respect to acidity, most nearly with that very feeble acid, carbonic acid. You know that sulphurous acid is used for the bleaching of silk, straw, &c., and for the preservation of catgut and things of that kind, which, if corrosive, it would be quite unfit for. Therefore, *per se*, it is not a corrosive substance, except in a concentrated form, and then but very feebly.

With regard to the amount of sulphur produced in the combustion of gas, the Act of Parliament says that 100 cubic feet of gas shall not contain of sulphur, in any form, more than 20 grains. Now, the ordinary mode of estimating the amount of sulphur in gas, consists in burning the gas somewhat in this form [illustrating], and then collecting the products of combustion, and estimating the sulphate of baryta obtainable therefrom. The process is based upon the assumption that the whole of the sulphur in the gas gets

burnt. But we know that the whole of the carbon does not, and neither does the whole of the sulphur; so that in a process of this kind we only estimate, so to speak, so much of the sulphur in the gas as in the burning of the gas gets converted into sulphurous acid. But in an experiment of this kind the gas is burnt under very different conditions to those under which it is burnt when we use it as an illuminating agent, and, so far as I know, no experiments have been made to show the amount of sulphurous acid produced by a certain number of cubic feet of gas when burnt in the ordinary way. A great many experiments have been made with the gas burnt in one small jet, or from a Leslie's burner burning at a very slow rate; but, so far as I know, there have been no experiments, at any rate not satisfactory experiments, where gas has been burnt at the rate of 5 cubic feet an hour, under the ordinary conditions; and it must not be assumed that the amount of sulphurous acid produced per cubic foot of gas is the same when the gas is burnt in two such different manners. It may be very different. So far, then, as regards the amount of sulphurous acid produced, all I can tell you is, that when gas is burnt somewhat in this way it gives rise to an amount of sulphurous acid which corresponds to about the 20 grains of sulphur allowed by the Act of Parliament. Very frequently it is two or three grains over; very frequently a few grains under. At the same time, when we perform the experiment, not in this way, but in a strictly chemical way, in a way in which it would be performed in a laboratory, under these circumstances we find the sulphur habitually to exceed the 20 grains allowed by the Act of Parliament; although, as I have said, when we have regard to the products of combustion yielded when the gas is burnt in an apparatus of this kind, we find it affords an amount of sulphurous acid or sulphate of ammonia corresponding with the average amount of 20 grains allowed by the Act of Parliament, and sometimes less.

Now let us consider the injurious effects likely to arise from the sulphurous acid so produced. The Act of Parliament says that coal gas shall not contain more than 20 grains of sulphur absolutely, and we find that, estimating it from the amount of sulphurous acid produced, it does not contain more than that quantity, although, estimating it according to the absolute amount of sulphur, it does contain more. What is the absolute amount ordinarily contained in coal gas I cannot tell you, although it certainly exceeds 20, and I believe even 25 grains in the 100 cubic feet; but we will make a very liberal assumption. We will assume that coal gas habitually contains 40 grains of sulphur in 100 cubic feet, and then consider how much sulphurous acid that amount of sulphur will produce. Sulphurous acid consists of exactly half its weight of sulphur; therefore, if the whole of these 40 grains were completely burnt, we should have 80 grains of sulphurous acid, but in reality a proportion of the 40 grains would not be so burnt. This 80 grains of sulphurous acid gas, however, corresponds to a little over the 1-15th part of a cubic foot, so that as 100 feet of gas, on the assumptions we have made, would yield us 1-15th of a cubic foot, 1500 feet of coal gas would be required to yield us one cubic foot of sulphurous acid; but when we burn 1500 feet of coal gas we produce something else besides sulphurous acid—the carbon and other constituents furnish their products to the atmosphere. Our 1500 cubic feet of coal gas required to produce one cubic foot of sulphurous acid would, at the same time, produce some 1000 cubic feet of carbonic acid; and, in addition to other far more abundant sources of dilution, the sulphurous acid would be diluted with 1000 times its volume of carbonic acid. Accordingly, if you could measure the proportion of carbonic acid gas in a room lighted by coal gas, and take the 1000th part of that proportion, you might form some idea of the proportion of sulphurous acid gas existing in the room. The highest result obtained by Professor Roscoe, as I have told you, amounted to ·32 per cent. of carbonic acid, but how much of that was produced by the gas burnt, and how much by the respiration of the persons present at the theatre, I cannot tell you; but you may form some notion of it by referring to the results of other experiments made in crowded sleeping-rooms with the windows shut, and also in some barracks. In these cases the proportion of carbonic acid, where no gas was burning, approximated very closely to the amount found in the gallery of the theatre, where it was furnished alike by the breaths of the individuals and the combustion of the gas. Moreover, we can form some notion of it another way. Speaking in round numbers again, every one of us produces about two-thirds of a cubic foot of carbonic acid an hour, which is the amount of carbonic acid gas that would be produced by the combustion of one foot of coal gas, so that every three individuals produce about as much as would be produced by one burner burning 3 feet an hour. I think we may take it for granted, therefore, that this ·32 per cent. found by Dr. Roscoe was contributed as largely by the individuals present as by the gas. We will assume, however, that of the proportion found by Dr. Roscoe—0·2, or nearly two-thirds of the whole—was produced by the combustion of the gas, and the remainder by the breaths of the people present. Assuming, then, that the atmosphere acquired 0·2, or one-fifth of a per cent., of carbonic acid, by the combustion of gas, and on our original basis, that the sulphurous acid produced amounts to the 1000th part of the carbonic acid, we should have present, in the air of the room, 1-500,000th—or a half-millionth—part of sulphurous acid: a proportion utterly insignificant. Further, to produce a cubic foot of sulphurous acid would require an hour's combustion of 300 burners consuming 5 feet of gas apiece; while to have a cubic foot of sulphurous acid existing at any moment in the air of any room, of whatever size, would necessarily require a much more abundant gas consumption, owing to the great change of atmosphere taking place every moment, even in the worst ventilated room.

But now comes the question of the conversion of the sulphurous into sulphuric acid. That, first of all, is not a rapid process. It is very rapid indeed so far as regards a partial conversion, for it is very difficult to have sulphurous acid in the air without a proportion of it being converted into sulphuric acid; but you must remember, when dealing with these minute proportions, that the minute proportions of other substances existing in the atmosphere become similarly important, and particularly the proportion of ammonia. It would appear that the amount of ammonia existing even in the open atmosphere is sufficient to neutralize the amount of sulphuric acid formed under the circumstances of gas combustion; but, in a room where a large amount of gas is burning—a room crowded with human beings—the exhalations give out an excess of ammonia, which would be sufficient to far more than neutralize any amount of sulphurous acid that might chance to get converted to sulphuric acid. Of course, if you set to work with a view to convert the sulphurous acid gas into sulphuric acid, you can readily do it. If you cause such a burner as this to burn under a vessel which is kept cold by having a free current of water passing through it, the bottom of the vessel is constantly covered with a layer of moisture; the sulphurous acid gets condensed in this moisture, and a portion of it converted into dilute sulphuric acid, which gradually becomes concentrated acid. In this way you may produce a certain quantity of sulphuric acid by the combustion of gas; but, when gas is burnt under ordinary conditions, so as to diffuse its products into the atmosphere, the produced sulphurous acid can only form about a thousandth part of the carbonic acid gas existing in the room as a product of gas combustion, even upon the excessive assumption that the gas contains double the amount of sulphur allowed by the standard of the Act of Parliament.

This brings to a conclusion what I had arranged to place before you this evening, and as I began with an apology, so also I think I must end with one for detaining you so long a time, and for talking to you, I fear, in an over-presumptuous style. But when you get into the habit of lecturing, when you have to lecture three days a week for nine months in the year, you not only get into the habit of lecturing those who came to be lectured to, but you also get into the habit of lecturing those who come to enter into a conversation with you; and if, in what I have said this evening, I have not apologized every moment, and said, "This is my opinion merely," you will be pleased to consider that as being what I meant. I do not intend to put forward what I have been saying as *ex cathedrâ* truth, but merely as what one medical officer of health might say to another. I have spoken of the matter as it struck me, and if there has appeared in my observations anything of the lecturer, as I have no doubt there has, I hope you will excuse it.

Dr. Letheby (at the request of the chairman) commenced the discussion, and said: I quite agree with the president that the association is much indebted to Dr. Odling for the excellent communication he has made to them. I only regret that the subject cannot be discussed as fully as it ought at this late hour of the evening, and, therefore, I will allude but briefly to one or two points of interest. A good deal of the discomfort which is generally complained of by those who use gas in their sitting-rooms is no doubt due, as Dr. Odling has observed, to the extravagant way in which gas is employed, as compared with other illuminating agents. To take this room, indeed, as an illustration—it is frequently lighted with half a dozen fishtail burners, each consuming about 4 cubic feet of gas per hour; and as each burner gives the light of about 10 candles, the total effect is the same as if 60 candles were burning in the room at one time; but who would think of committing such extravagance by lighting it up in such a manner. It must not be forgotten, too, that every cubic foot of coal gas produces by its combustion about six-tenths of a cubic foot of carbonic acid, and as this is very nearly the quantity of carbonic acid produced by an adult person in an hour, it is evident that the 24 feet of gas hourly consumed by the 6 fishtail burners are equivalent in their vitiating effect on the atmosphere of the room to the presence of 24 persons beyond the actual occupants of it. Let us look at this a little closer. A cubic foot of coal gas requires 6 cubic feet of air to consume it, and it produces six-tenths of a cubic foot of carbonic acid gas. The 24 feet of coal gas, therefore, consumed per hour by the 6 burners will destroy 144 cubic feet of air, and produce 14·4 cubic feet of carbonic acid. Now an atmosphere containing as little as 1 per cent. of carbonic acid will soon produce discomfort, if not actual illness; and at this rate the 6 burners will vitiate and destroy no less than 1584 cubic feet of air per hour. No wonder then that a feeling of oppression and discomfort is soon perceived in a room where gas is burnt at such an extravagant rate. But this is not all, for the heat of the burning gas is also extremely oppressive. A foot of gas, in burning, will raise the temperature of 3050 cubic feet of air from 60° of Fahrenheit to 70°, and hence the distressing feeling of warmth and discomfort when gas is used in such a profuse manner. It is very probable, too, that the large amount of hydrogen contained in coal gas—it being much more than in any other illuminating agent—may have a good deal to do with the discomfort complained of, for hydrogen in burning produces aqueous vapour, which saturates the air with moisture, and so prevents the warm skin from disposing of its secretion by insensible perspiration. Instead, therefore, of our being cooled by the natural process of silent and insensible evaporation from the surface of the body, the air, from its being overcharged with moisture, refuses to absorb the perspiration, and it oozes from the body in a fluid form, producing, as it always does under such circumstances, a sense of discomfort. And then, again, it is remarkable how freely the radiant heat of the burning hydrogen is communicated to the molecules of aqueous vapour in the atmosphere, and thence to the water in our own bodies. All these circumstances are concerned in the frequently observed distressing effects of gas when it is improperly used in our living-rooms. And now I am desirous of making a few remarks on the effects of the sulphur in coal gas. Dr. Odling has directed your attention to this matter from a statistical point of view, and has shown you how, by a mathematical process, the amount of sulphur acids in the products of burning gas may be reduced to a vanishing point, and that, therefore, they must be insignificant and wholly harmless; but I will ask you to look at the subject from another point of view, and to examine it by the light of facts as well as of figures. About 15 or 20 years ago, when I began to inquire into this matter, I was struck with a circumstance which is now, as it was then, very remarkable—namely, that wherever gas is burnt continuously, and in large quantity, it causes a rapid destruction of textile fabrics, with a very acid condition of them. This is notably so in our public libraries, and in warehouses and shops. I obtained so many striking proofs of this, especially from the libraries of the Athenæum Club-House, the London Institution, the College of Surgeons, and elsewhere, that I made them the subject of a special report to the City authorities in 1854; and here you will see the specimens of covers of books which were furnished to me at that time. If you apply a little piece of the leather to your tongue, you will taste its acidity; and if it be treated with water or spirit of wine and tested with a solution of baryta, it will be found that the acid is sulphuric acid. These effects were observed many years ago in the library of the Athenæum Club-House, and they were growing to be so serious that the managers requested a commission of chemists—including Mr. Faraday, Mr. Brande, Dr. Prout, Mr. Aiken, and others—to inquire into it, and I have before me a copy of their report on the subject. It is to the effect that the mischief is clearly due to the presence of sulphuric acid which had come from the burning gas; and they state that the mischief will continue so long as gas is used in the library without proper ventilation. Mr. Faraday thereupon designed the system of ventilation which is still used in the library. As to the effects of the products of burning gas on shop goods, they are notorious, for such articles are regularly disposed of as damaged or gassy things. It has been remarked, too, that plants are quickly killed by the products of burning gas, for they are peculiarly susceptible of injury from the presence of sulphurous acid in the air. According to Drs. Christison and Turner, as little as 1 part in 10,000 of air will kill plants in less than 24 hours. And you cannot use gas in a conservatory, either for heating or for illuminating purposes, unless the products of combustion are entirely removed. Dr. Christison has written to me very strongly on this subject, and he attributes the absence of flowers and plants from the rooms of Edinburgh to the circumstance that gas is universally used in them. Advancing a step further in my inquiries, I ascertained that the water produced by burning gas, collect it how you will, is always acid, and will rot leather, paper, cotton, and linen. Here are specimens of such tissues, which have been dipped in the condensed liquid products of gas combustion, and you will observe that they are as rotten as tinder. Lastly, I contrived a plan whereby the amount of sulphur in coal gas could be estimated. I had thought that the instrument was sufficiently well known, and the *rationale* of its action thoroughly understood; but the instrument which Dr. Odling has placed

upon the table, and has described to you as my ingenious contrivance, is so different in all its essential particulars from my instrument, that I disown it, and call it an ingenious perversion of the apparatus which bears my name. I know from experience that such an instrument will not discover half the amount of sulphur that is really present in coal gas; and I have no doubt that the discrepancies which have lately been referred to by writers on this subject have been occasioned by the use of such an instrument as is now upon the table. The particulars of my instrument, the measurements of the several parts of it, and the mode of using it, are fully described in Mr. Sugg's book on gas manipulation, and if it be used in a proper manner it will discover all the sulphur of the gas; and thus it will be found that the amount of sulphur may reach to from 30 to 40 grains per 100 cubic feet of gas. If the presence of sulphur in such quantity in coal gas was an unavoidable necessity, and could not be reduced by any reasonable process of manufacture or purification, it would be folly to complain of it, other than to show the necessity for good ventilation where gas is burnt; but this is not the case, for there are processes of purification which will easily diminish the amount of sulphur to less than half the usual quantity. Mr. Hawksley—whose presence this evening will, I hope, be useful to us, by his giving us the results of his large experience in this matter—has shown that, by copiously washing raw gas with ammoniacal liquor, it is possible to remove a large proportion of the sulphur compounds of gas without injuring in the slightest degree its illuminating power. After this treatment the gas should be deprived of its sulphuretted hydrogen by means of hydrated oxide of iron; and then, while a little ammonia is still remaining in it, it should be further purified by passing it through dry lime, which is the slightly moistened hydrate of lime. In this way the ammoniacal liquor is strengthened to a high degree—it being rarely less than of 10-oz. strength—by the absorption of ammonia compounds, and by the removal of sulphur in other forms than that of sulphuretted hydrogen. The hydrated oxide of iron is also less foul than it usually is, and is capable of revivification without causing annoyance; while the hydrate of lime is actually inoffensive, for it contains nothing but carbonic acid and sulphocyanogen, with a little sulphide—the carbonic acid being absorbed from the gas, and the sulphocyanogen and sulphide produced by the reaction of ammonia on bisulphide of carbon in the presence of caustic lime. Mr. Hawksley will tell you, what I also know from experience, that by these means the amount of sulphur in coal gas is easily and certainly reduced to about 10 or 12 grains per 100 cubic feet of gas. It is easy, as I have said, to meet this question by a numerical argument, and to show, by a mathematical process of reasoning, that the amount of sulphur in gas may be made to vanish to almost nothing; but I would rather examine the practical or experimental facts, and endeavour to remedy what is, among practical men, an acknowledged evil, by applying those remedies which are clearly within our reach.

Mr. HAWKSLEY said there were one or two points in regard to which, as he had been called upon, he would take the liberty of making observations. In the first place, he would refer to what Dr. Odling had spoken of as the dirtiness of gas. Gas might, like any other combustible, be made the means of dirtying anything with which the air in which it was burnt came into contact. He doubted very much whether in general the dirtiness was produced to any sensible degree by the gas itself. He thought it was not. Gas must be burnt very badly indeed if any notable quantity of carbon escaped. There was a flame, as an instance, burning immediately above him, which he had no hesitation in saying was burning without any escape of carbon, yet if that flame were allowed to burn in the condition in which it stood under the ceiling for any considerable time, the ceiling would become black. Now we found exactly the same effect produced by a steam-pipe, from which nobody could say that the products of combustion escaped. Two black marks on the roof or ceiling over the steam-pipe would be observed, one immediately on each side of the pipe, and a white place in the middle—the ordinary colour of the ceiling round. This was only occasioned by the warm current carrying the particles of dust up against the ceiling, and lodging them by the violence, if he might use the expression, of the collision with which they came in contact with the ceiling. The smoke or dirt, or whatever there might be in the room, become immediately attached to the ceiling, and occasioned that remarkable blackness which was commonly attributed to the escape of carbon from the gas. Now, in illustration of that being the fact, he would just take occasion to observe that it was a very common expedient, though a very imperfect one, to place a plate immedietely over the ceiling to save it from being blackened. That was simply because the heated air had to escape by the sides, and so become cool, and there was not the same rapidity of motion against the ceiling. He considered that to be a very manifest illustration of the proposition which he had laid down; therefore, gas was not that dirty agent which many persons supposed it to be. Then Dr. Odling had said something on the subject of colour of gas—he had mentioned the pale light and the yellow light. Now he (Mr. Hawksley) entirely differed from him on that subject, just as he should differ from him if he were to say that the light of the sun on a frosty day was superior to the light of the sun in the summer. Every one knew that the light of the sun in summer was much more agreeable than the pale light; therefore, instead of commending the light which Dr. Odling had pronounced to be so beautiful, he should speak of it in the opposite terms. That, however, was not a matter of much importance; but there was one thing which Dr. Odling had not made clear, and he (Mr. Hawksley) could not make it clear, which was nevertheless an interesting subject, well worthy of investigation, and that was the cause of the particular chokiness which was perceived occasionally (not always) in the gas which was supplied to the public. Now, he did not think this was at all produced either by acridity or excessive humidity, or by the presence of sulphurous or sulphuric acid in the atmosphere; it was something *per se*—it was a something which had an effect upon the throat, producing dryness, and at the same time seeming to be consequent upon a large amount of invisible smoke in the atmosphere. He used the word smoke, however, not as he had used it before, but in another sense. Now, he believed that the cause of that effect had never yet been ascertained. What was more remarkable about it was that it was not always present. It was found to be more frequent in gas when it was purified by the oxide of iron than when purification was effected by lime, and it was found the more frequent also when the gas was purified by either of those agents without being previously exposed to the action of moisture, whether that moisture were offered to it in the form of ammoniacal liquor, or whether it were offered in any other way. In any case the chokiness was very perceptible, and ought certainly to be removed by whatever agent was necessary for that purpose before the gas was sold to the public. He could not make out what it was from which this effect proceeded, but he knew that it might be in a great measure prevented by having regard to certain kinds of purification. He was enabled to state that by the use of ammoniacal liquor for the purpose of washing the gas, by the use of lime in the process of purification, the sulphur could be reduced, without any sensible depreciation in illuminating power, to as little as 10 grains in 100 feet—that was to say, to as little as one-half the quantity which was allowed by Act of Parliament. Now, it might be said that this was not worthy the attention of professional men in that room. It was said, and said with some truth, that the gas companies had been driven away from the use of a very valuable agent by persons who complained that the use of lime in the purification of gas was a nuisance. They had consequently been driven to employ the oxide of iron, which was a very imperfect agent for the removal of some of the compounds, and the general result was that, in order to free our streets from the occasional smell of foul lime, we put sulphur into our dwelling-houses. He did not think it was any improvement in a social sense at all, and it was always desirable to ascertain whether, in effecting changes which might be proposed, and which might appear to be beneficial, we were not producing injurious effects in another direction. However, such had been the results. He did not think, with regard to the question of the presence of ammonia, that any notice whatever, in the present state of the manufacture of gas, need be taken of that agent. The quantity was so small, even in the gas which was the worst purified in the sense of the removal of ammonia, that he did not believe any effect at all—any appreciable effect—detrimental or otherwise, would arise; and he would say this with regard to the alleged effect of gas upon books, and furniture, and other articles of that sort, that, although he believed there had been a considerable effect produced when gas was very much more purified than it was at the present day, yet he believed there were now other causes operating to produce the effect, which were at least as great as gas, if not greater. The quantity of coal consumed in London gave off more than 6000 tons of sulphur into the atmosphere every year, and so large a quantity as that must in itself produce a very sensible effect—in point of fact, we knew it. But besides that we must not forget the influence of temperature. With a large quantity of gas burnt in a room, near the ceiling, unless special means of ventilation were adopted, the temperature would be very high indeed—so high that it would be impossible to exist in it for many minutes, perhaps not for one. Well, now, that had a very serious effect upon books and furniture, and he attributed very much of the rottenness of books—always greater on the higher shelves than on the lower—to that cause. He believed gas had been very largely discredited in consequence of the joint operation of other influences which did not proceed from the combustion of gas itself.

Mr. LIDDLE said he had not intended to take any part in this discussion, but when he was told that the medical officers interference had prevented the gas companies from supplying gas purified in a proper way he thought it was time to say something. He concluded Mr. Hawksley was finding fault with the medical officers because they had endeavoured to prevent nuisances to persons living in the neighbourhood of gas-works by the use of wet lime. It had been a most intolerable nuisance. It was not necessary that wet lime should be used, because a large quantity of sulphur could be taken out by oxide of iron. There was no doubt whatever that it had a considerable effect in taking out the sulphur, and there was no smell arising from it; at the same time dry lime might be used as well as the oxide of iron, whereby a larger quantity of sulphur would escape. He believed that the inconvenience, great as it might be, of sulphur entering into rooms, and destroying books, &c., was much less than the injury to the neighbourhood generally by the use of wet line. He believed a great deal of the inconvenience complained of might be obviated by proper ventilation, but if people would burn gas in rooms without proper ventilation they must put up with the consequences.

Mr. FINLAY said he had been connected with two of the largest gas companies in London for 16 or 17 years, and he quite agreed with the remarks of Mr. Hawksley about the use of lime. It was a question whether they ought not to go back to the old practice. It was well known that there was no better process of purification than by means of wet lime. Whether they worked wet lime or dry lime, it must always be a nuisance to a certain extent. Although he was not connected with the Great Central Company, he could mention that he knew summonses had been taken out in six or seven instances at the Thames Police Court for nuisance, and the company was called upon to use the oxide of iron process. Another company—the Commercial—used the wet lime proces, the consequence being that they had occasionally to paint down the front of a row of houses, and the result was that they abandoned the process and worked the oxide of iron. As regarded the question of sulphur, he quite agreed with the remark that the inconvenience attributed to it was occasioned very often by a want of ventilation. He knew a tailor's shop where £150 a year was paid for gas. There was no ventilation, and the man always complained of his cloth being quite rotten. It was easy to understand how that was; it was hot enough to fry the cloth. He did not mean to dispute the fact that there was sulphurous acid in the gas, but what he contended was that when a man built a tailor's, draper's, or milliner's premises he ought to provide proper ventilation, and allow this sulphurous acid to pass off. The same effect would be produced by any other illuminating agent, and therefore it was unfair to blame the gas for that which people had it in their power to prevent.

Dr. ALDIS said he should be very sorry for us to have to return to the days of "blue billy," a most offensive compound. He thought one matter requiring attention was the kind of glass which surrounded the gas when it was burning. One-fourth of the light was lost by the mode in which it was burnt. It was very seldom that we saw a glass having one part opaque and the other clear. He could confirm what Dr. Letheby had said about the destruction of books. The College of Physicians had recently suffered in this way, and they had just had the library glazed for the purpose of saving the books.

Mr. RENDLE said this discussion had removed all doubt in his mind upon one point—viz., the necessity for gas companies to go to a distance from London. We must have gas, and it appeared that the process of purification by wet lime ought to be adopted. The logical conclusion of the discussion was therefore that, as gas could not be purified except by a most offensive process, and as gas must be made, the gas companies ought not to exist longer in the midst of a large population.

Dr. GIBBON could not agree with Dr. Letheby about the effect of gas upon plants in greenhouses. He knew several cases in which gas was constantly used without the flowers being bleached or destroyed. Nosegays were perishable articles, and died in ball-rooms long before the ball was over, even where there was no gas. He attributed a great deal of importance to the mode in which gas was burnt. At the church in Holborn they were burning Argand burners with globes round them, and complaint was made of the heat. He said, "Remove the glass, and I believe it will make a great difference." His suggestion was carried out, and horizontal burners substituted, the result being that they had since been able to sit in the church with great comfort.

The CHAIRMAN said he should like to have heard a few remarks on the subject of the effect of gas on the eye. He found a reading-lamp was the only thing he could tolerate, because it lighted his book or paper without strongly illuminating the room. Something convenient was wanted that would give as much light as four or five candles over the object it was desired

to look at. That kind of thing would be very convenient to many a literary man who wished to have gas in his study.

Dr. ODLING, in reply to the various remarks, said everybody agreed that, for the purposes of study, it was by far the pleasantest thing to have the room tolerably dark, with the light shining full upon the object to be seen. He did not know whether Mr. Hawksley's remarks called for any observation from him. His experience entitled his remarks to considerable weight. As to the matter of chokiness—that the chokiness appertained to some gases and not to others had been made the subject of notice, and he could only regret that he should have left this matter in an uncertain state; but it was no good to attempt to explain that which was at present inexplicable. He could not say why the chokiness should be experienced in some cases more than in others, but he thought he was capable of saying that it was not caused by the presence of sulphurous acid gas. He was sure they were all indebted to Mr. Hawksley's efforts and success in the removal of sulphur from gas. They must all agree that the less sulphur the better; but because the use of lime should be resorted to, it was no reason that we should return to the practice of having offensive smells. The two things were by no means associated; every day's experience went to show that if ten years ago gas-works could be conducted in towns without objection, much less need there be any objection now. He was not prepared to speak very positively on the subject mentioned by Dr. Gibbon. The heat of a room lighted by gas depended, no doubt, in part, and to a considerable extent, upon radiation, but it depended also, in yet greater measure, on diffusion by the mixture of heated particles of air. He rather thought it would be found that, by the substitution of bat's-wing or fishtail burners, in the church to which Dr. Gibbon had referred, and by the taking away from each light the inner and outer shades, what had happened was that a smaller consumption of gas was needed to give the same light, and consequently that a smaller amount of gas was burnt and of heat was produced. That Dr. Letheby had succeeded in obtaining sulphuric acid from gas was not surprising; he (Dr. Odling) thought he could have succeeded also had he tried. With regard to conservatories, he would rather refer the question to those who had more experience of the effect of gas in them than he had, but he was not at all persuaded that gas could not be used by his gardening friends. As to the effect on books, if any one went into a room lighted moderately with gas they would notice a remarkable difference of temperature between the top and bottom of the room. Leather, no doubt, did suffer greatly from alterations in temperature and moisture, and it was nothing extraordinary if it became rotten when much subject to these variations. But the binding had an acid reaction, it was said! Well, in most book-binding there was a certain amount of paste used, and most paste had alum in it, and alum contained sulphuric acid. There was a great difference in leather. It was well known that books bound in red cloth were not much affected by acids, but those with black, or purple, or green cloth showed a red mark if the minutest drop of the most dilute sulphuric acid was put on them, but he had observed no such effect in gas-lighted libraries. That there was an amount of sulphur produced by gas he did not deny, but he contended that the amount of sulphuric acid produced in a room was not more than the ammonia in the room was capable of neutralizing, and converting into sulphate of ammonia.

The proceedings then terminated.

PARIS UNIVERSAL EXHIBITION, 1867.

REPORTS OF CAPTAIN WEBBER AND MR. ROWDEN ON EXPERIMENTS IN THE TESTING-HOUSE.

The Relative Illuminating Powers of the London and Paris Standards of Light.

The English standard of illuminating power is the light of a sperm candle burning 120 grains per hour. The candles used for the following experiments were supplied by Mr. Field, of Lambeth, who manufactures candles expressly for photometric experiments. From their appearance when cool after use, they seemed very pure, and they burned with great regularity.

This candle is used with the ordinary Bunsen's photometer, which is a graduated rod, at the ends of which are placed the two lights to be compared. A moveable disc of paper, with a small central ring, rendered translucent by some oily or waxy substance, is placed in a line between the two lights. By sliding this disc along the rod till the central spot either entirely disappears or the lights on both sides have the same relative intensities when compared with the surrounding parts, the operator can judge when the two flames shine equally brightly on their respective sides of the disc; then, referring to the scale below, the pointer attached to this disc shows how many times greater one light is than the other, these numbers having been previously calculated from the well-known law that the intensity of light varies inversely as the squares of the distances.

The French standard of illuminating power is the light given by a moderator lamp of stated dimensions, burning 42 grammes of pure colza oil per hour.

These dimensions are as follow:—

Exterior diameter of wick-holder	23·5	millimètres.
Interior diameter of wick-holder	17	,,
Total height of glass chimney	290	,,
Distance from the shoulder of chimney to its base	61	,,
Exterior diameter immediately below the shoulder	47	,,
Exterior diameter at the top of the chimney	34	,,
Mean thickness of glass	2	,,

The ordinary wick is used, but it must contain 75 strands, and a decimètre in length must weigh 3·6 grammes.

A new wick must be used each time the lamp is lighted. It should be made even at the top, and set to a height of 10 millimètres above the holder. The shoulder of the chimney should be about 7 or 8 millimètres above the top of the wick. A lamp thus arranged will consume about the required quantity of oil per hour. Any variation from this quantity may be corrected by slightly raising or lowering the chimney as the case may require.

If the lamp burns more or less than 42 grammes per hour an allowance may be calculated for it, provided the amount consumed is between 38 and 46 grammes, but beyond these margins no calculation is permitted. To determine the consumption of oil without removing the lamp from its photometer, a special balance is constructed by M. Deleuil, of Paris. One of its arms is forked at the end to receive the neck of the lamp, which is supported by a pan hanging from two knife edges, one on each arm of the fork.

The photometer used is one arranged by MM. Dumas and Regnault. The two lights to be compared are placed on the same side of a vertical dark screen, a small opening in which is filled by a plate of glass coated with a solution of starch. The two flames are placed at equal distances from the plate of glass, and in such positions that the line joining them is parallel to the plane of the glass, and the two lines joining the centres of the flames and the centre of the glass meet at an angle of from 30° to 40°, these three lines being horizontal.

A vertical strip of thin wood is fixed in front of the screen, so as to allow each light to shine only on one half of the opening.

The experimenter places himself behind the screen, where he can readily see which light is burning more brightly, and, by regulating the consumption of one or the other, he is able to equalize them.

In testing gas in England a standard candle is placed at one end of the photometer, and at the other an Argand burner of definite dimensions and with a chimney of a given height, is made to consume a given number of cubic feet of gas per hour. The two lights are then compared, and, after proper allowances for the variation from a consumption of 120 grains per hour by the candle, the gas is said to be of so many candle power. In Paris a standard Argand burner is made to consume sufficient gas to give the same light as the standard moderator lamp above described; the quality of the gas will therefore be inversely as the consumption.

For the results of the following table a standard moderator lamp, lent by M. Deleuil, was used. Each result is the mean of observations at intervals of two minutes, extending over one hour, and in most cases made by two observers:—

Table of Comparison between English and French Standards of Light.

Number of Observation.	English Standard, Candle burning 120 Grains per Hour.	French Standard, Lamp consuming 42 Grammes per Hour.
1	1	9·6
2	1	9·73
3	1	9·5
4	1	9·5
5	1	9·92
6	1	9·7
7	1	9·81
8	1	9·59
Average		9·66

To check this result the candle was compared with the light of the Paris standard Argand, consuming 105 litres of gas per hour, and which ought by the Paris gas regulations to give an illuminating power equal to that of the lamp.

The average of several observations gave—

English Standard, Candle.	French Standard, Burner consuming 105 Litres per Hour.
1	9·56

This differs from the other result by 1-10th of a candle.

Advantages of the French System over the English System of Testing the Quality of Gas.

The light of a candle is very irregular, even with a uniform consumption. Every draught affects not only the amount burned, but the amount of light evolved by a given weight of the candle. The light also depends on the shape of the wick in the flame. By managing the wick one may obtain a variation in illuminating power of at least 10 per cent., after making due allowance for the increased or decreased consumption. Even although any individual experimenter, by constant practice with his candles, under certain conditions may be able to depend upon his results as compared one with another, yet what is his standard of light may not be that of another experimenter whose candle is burning under different conditions. Thus, while a candle is subjected to so many uncontrollable influences it can form no universal standard of light. An experimenter has no control over the amount consumed by his candle, yet beyond a certain limit it is not sufficiently accurate to calculate the illuminating power due to 120 grains from that obtained by a greater or less consumption. The above objections apply, even supposing that the material and wicks of the candle are in every case precisely similar, which in practice is well known not to be the case.

When comparing the flame of an Argand gas-burner with that of a candle, there are two lights very different in power, size, and quality, whereas for accuracy the flames should be as nearly as possible on an equality in these respects.

With the standard moderator an ordinary draught, such as would considerably disturb the burning of the candle, would be harmless. The wick is always as nearly as possible under the same conditions; its height is always the same, and, being only a carrier of oil and quite below the flame, it cannot influence the light as does the wick of a candle, which is in the flame and gradually burning away. Further, one is able to test the wick of a moderator before using it, but the wick of a candle must be entrusted solely to the care of the makers. In power, size, and quality of the light the standard moderator is as nearly as possible similar to the gas-burner. As regards the purity of the combustible, it appears that purified colza oil of commerce is as much to be depended upon as sperm candles.

Quality of Paris Gas.

From a series of observations made by the standard candle and the London Argand for 12-candle gas, the following results were obtained:—

Number.	Candle Power of Argand, consuming 5 Cub. Ft. per Hour.
1	12·4
2	12·59
3	12·3
4	12·55
5	12·46
6	12·4
Aug. 15, morning	13·4
Aug. 15, afternoon	13·6
Aug. 16, morning	12·9

Omitting the results of the 15th and 16th of August, on which days the gas was much above the ordinary illuminating power, the average result is 12·45-candle power.

Experiments on Gas-Burners.

The standard light used in these experiments was that of a 12-candle Argand burner, such as is used for testing gas in London, consuming 5 cubic feet of gas per hour. It was lent by Mr. G. Glover.

This standard has been taken as equal to 12·45-candle power, but, should the gas have varied, the results would as nearly as possible have the same value.

The photometer was placed at the disposal of the Testing Committee by Mr. Leoni, of St. Paul's Street, New North Road, London. It consisted of two excellent wet meters, one at each end of the bar. From the tops of these ran two vertical hollow bars, which served the double purpose of supports to the bar and outlets from the meters. Two stop-cocks in each of these rods regulated the gas, the lower ones being supplied with screw adjustments. Between the two cocks the pressure-gauges were connected.

The meters were adjusted, at intervals of seven or eight days, by Mr. Glover's standard gasholder, which has already been noticed.

In making an experiment, the standard Argand was screwed above one meter and made to consume 5 cubic feet per hour. The burner to be tested was then fastened above the other meter, and its consumption regulated as required. Results were thus worked out:—Suppose the pointer of the moveable disc marked 1·2 on the side nearer the standard, this proved that the light being tested was 1·2 times the power of the standard, and so $12{\cdot}45 \times 1{\cdot}2 = 14{\cdot}94$ candle power. If the pointer marked 1·2 on the side farther from the standard, it proved that the standard was 1·2 times greater than the other, and therefore that the latter was $12{\cdot}45 \div 1{\cdot}2 = 10{\cdot}38$ candle power. The advantages of using a gas-burner for comparative results with gas-jets are—

1. The lights are as nearly as possible under the same conditions of intensity, quality, and size.
2. Expedition in obtaining results.
3. Less error from the variation in the quality of gas. Within the small margins allowed for variation by the Paris gas regulations the error would be scarcely appreciable, as a diminution in the light of the burner experimented on would be almost counterbalanced by a diminution in the light of the standard.

Only one quality of gas could be used, hence the experiments are necessarily imperfect.

TABLE I.—*Argand Burners.*

Name of Maker.	Diameter in Inches. External.	Internal.	Of Centres of Ring of Holes.	Number of Holes.	Size of Holes.	Consumption in Cubic Feet per Hour.	Pressure at Exit from Burner.	Illuminating Power.	Remarks.
Sugg's, for 12-candle gas.	1·1	·45	·825	15	·06	4·	·03	—	Glass 7 inches high in every case.
						5·	·04	12·4	
						6·	·05	16·8	
Sugg's, for 14-candle gas.	1·1	·47	·825	15	·06	5·	·05	12·45	
						6·	·06	16·4	
Sugg's, for 16-candle gas.	1·1	·55	·825	15	·06	5·	·03	11·9	
						6·	·04	16·2	
Sugg's, for 18-candle gas.	1·1	·58	·825	15	·06	5·	·04	11·3	
						7·	·05	20·5	
Sugg's, in brass.	1·1	·5	·825	15	..	5·	·05	10·4	Flame very pointed.
						6·	·06	15·5	
Sugg's, in porcelain.	..	..	·825	38	..	5·	·05	10·0	
						7·	·065	19·9	
Sugg's, with continuous opening instead of holes	1·2	·57	·9	..	·012	5·	·2	11·9	Short flame.
						7·	·28	19·3	Flame forked.
Sugg's, another size.	1·2	·65	·9	..	·017	5·	·15	9·3	Short flames.
						7·	·21	17·4	
Sugg's, small Argand	·8	·36	·6	20	·03	3·5	·07	9·8	
						4·	·08	11·4	Very good flame.
						4·5	·1	13·0	
Leoni's, for 14-candle gas.	1·13	·5	·85	15	·06	5·	·05	12·3	
						6·	·07	15·5	
						7·	·1	19·2	Very good flame.
						8·	·11	25·0	
Leoni's	1·15	·6	·87	36	·02	5·	·55	8·2	A large portion of the flame blue.
						6·	·7	10·4	
						7·	·9	13·7	
Leoni's	1·1	·75	·93	40	·025	5·	·2	11·3	
						6·	·27	16·2	
						7·	·35	19·9	
						8·	·45	17·4	
Leoni's	1·5	·85	1·18	60	·025	10·	·65	26·1	Glass, $10 \times 2{\cdot}5$.
						11·	·8	29·8	
						12·	·94	33·6	
Leoni's	·95	·47	·75	24	·025	4·	·3	6·9	
						5·	·4	10·4	
						6·	·5	16·2	
						6·	·7	11·0	The gas passed thro' a tube in centre of flame, and so became heated before it issued from the jet.
						7·	·9	16·3	
Benham's, Argand, of globe light	..	..	1·0	30	..	6·	·35	10·7	The central pipe was left in, and gas admitted from below.
						7·	·5	16·2	
						6·	·33	11·3	The central pipe entirely removed, and the burner used as an ordinary Argand.
						7·	·45	16·8	
Schaeffer & Walcker, in porcelain.	..	..	·75	32	..	5·	·1	11·9	
						6·	·17	16·2	
						7·	·23	21·2	
Bengel's	·95	·55	·75	40	·025	3·	·06	3·8	Flame almost all blue.
						4·	·09	7·8	Flame very blue.
						5·	·1	12·45	Flame good.
						6·	·14	16·2	
						7·	·18	20·5	
Bengel's, the standard or Bengel burner for testing gas of Paris	·87	·37	·65	30	·025	3·	·09	5·8	*See* detailed description below.
						3·5	·09	9·5	
						4·	·1	10·9	
						5·	·12	13·7	

The Argand burners of Mr. Sugg, of Westminster, London, were made for consuming 5 cubic feet per hour of gases of various qualities. The ring in which the holes for the exit of gas were drilled was made of earthenware, and so not liable to corrosion. It was mounted in brass, and the whole burner well finished. Two of the burners had circular slits instead of holes, but they did not appear to be an improvement on the ordinary form, at least with Paris gas.

In the burners of Mr. Leoni, his patent adamas supplied the place of the earthenware ring. This material is particularly well adapted for gas-burners. It stands heat perfectly, does not corrode during years of use, and is sufficiently hard to resist even very rough usage. The gauges are thoroughly to be depended on. His "6-10ths pressure jet" was tested by a gauge made by Deleuil, and the difference between the diameters of two, which varied most out of about twenty taken at random, was less than 2-1000ths of an inch. The variation in the ordinary jets was also very small.

The Bengel Standard Burner.—This Argand is that used for all gas-testing in Paris. It was said that this burner was the best for consuming 105 litres of gas per hour, but a small Argand sent by Mr. Sugg seems better.

The following results were obtained:—

For equal quantities of light—

Sugg's small Argand, with 7-inch chimney, consumed per hour	101 litres.
The Bengel burner consumed per hour	105 ,,
The English standard 12-candle Argand, 7-inch chimney, consumed per hour	115·5 ,,

The dimensions of the Bengel burner are as follow:—

Total height of burner	80 millimètres.
Height of the cylindrical part	46 ,,
Exterior diameter of cylindrical part	22·5 ,,
Interior diameter of current of air	9 ,,
Diameter of the circle passing through the centres of the holes	16·5 ,,
Diameter of holes	0·6 ,,
Number of holes, 30.	
Height of glass chimney	200 ,,
Diameter of glass chimney { Top	52 ,,
Diameter of glass chimney { Bottom	49 ,,
Thickness	3 ,,
Distance from bottom of chimney to top of burner	31 ,,

Note.—1 millimètre = 0·0393 inch.

The cylinder forming the burner is of porcelain, and it is enveloped below the support for the chimney by a thin case of porcelain, which tapers downwards from the base of the chimney to the base of the cylinder. For admission of air this case is perforated by 30 holes of 3 millimètres diameter.

The results of the experiments with the burner of Benham's globe light seem to prove that no advantage in illuminating power is gained by his arrangement for passing gas through the red-hot tube in the centre of the flame, although it is a very convenient way of supplying gas to his burner.

TABLE II.—*Bat's-wing Burners.*

Name of Maker.	Gauge of Opening.	Width at Base of Opening.	Height of Opening.	Consumption p. Hour in Cubic Feet.	Pressure at Exit of Gas.	Illuminating Power.	Remarks.
				Ft.			
Leoni, No. 4	·012	·31	·13	3	·57	3·5	
				4	·8	4·2	
				5	1·05	5·0	The pressures in this case are not worth notice, as the burners were plugged with wool. Many burners were tested with and without this wool, but with no perceptible difference in illuminating power.
Leoni, No. 5	·015	·31	·13	3	·31	5·0	
				4	·46	6·2	
				5	·6	8·2	
				6	·77	8·9	
Leoni, No. 6	·017	·31	·13	3	·29	5·2	
				4	·4	7·6	
				5	·05	8·5	
				6	·65	10·0	
Leoni, No. 8	·02	·31	·13	4	·33	8·3	
				5	·42	10·4	
				6	·55	12·5	
				7	·66	14·9	
				8	·78	16·2	
Leoni, Bat's-wing economizer, No. 3	..	..	..	3	·36	5·8	
				4	·47	8·3	
				5	·65	10·4	
				6	·8	11·9	
				7	·97	14·3	
Leoni, Bat's-wing economizer, No. 4	·012	..	..	3	·24	5·4	This burner gave a very good flame. It required a pressure of 2·5 to cause it to roar.
				4	·35	8·0	
				5	·45	10·6	
				6	·58	13·7	
				7	·71	15·5	
Leoni, Bat's-wing economizer, No. 6	·018	..	..	4	·15	8·0	Flame flickers.
				5	·22	11·3	Flame still flickers.
				6	·28	14·7	Flame flickers slightly
				7	·35	17·4	
				8	·4	19·9	
				12	·77	30·0	Very good flame.
Bat's-wing burner used in all street-lamps of Paris	..	..	..	3	·09	6·2	Flame rather unsteady
				4	·1	8·3	
				5	·15	10·9	
				6	·2	13·7	Steady flames.
				7	·25	16·2	
				8	·31	18·6	
Sugg's earthenware tips, No. 4.	·014	..	..	3	·45	3·6	
				4	·63	4·7	
				5	·87	5·9	
Sugg's earthenware tips, No. 6.	..	..	..	3	·35	4·4	
				4	·51	5·6	
				5	·7	6·9	Roars.
				6	·94	8·4	
Sugg's earthenware tips, No. 7.	·018	..	..	3	·29	4·7	
				4	·42	6·3	Some noise.
				5	·55	8·0	Noise increased.
				6	·75	9·2	Roars.
Sugg's earthenware tips, No. 8.	·02	..	..	3	·2	5·6	
				4	·29	7·4	Considerable noise and unsteadiness.
				5	·43	9·6	Noise increased.
				6	·57	10·8	Roars.
				7	·71	12·45	Roars badly.
Sugg's very large burner	·02	·45	·3	4	·18	8·9	
				5	·22	11·9	Flame unsteady.
				6	·28	14·9	

TABLE III.—*Fishtail Burners.*

Name of Maker.	Diameter of Holes.	Consumption p. Hour in Cubic Feet.	Pressure of Gas at Burner.	Illuminating Power.	Remarks.
		Ft.			
Leoni, No. 4	·04	4	·75	4·5	
		5	1·0	5·0	
		6	1·35	5·5	
Leoni, No. 5	·047	4	·47	5·3	
		5	·65	6·1	
		6	·85	7·6	
		7	1·1	8·3	
Leoni, No. 6	·051	4	·45	6·3	
		5	·6	8·1	*See* remark in Table II. opposite Leoni's Bat's-wing Burners.
		6	·78	9·0	
		7	1·0	10·4	
Leoni, No. 7	·057	4	·33	8·0	
		5	·44	10·3	
		6	·57	12·4	
		8	·91	14·8	
Leoni, No. 8	·066	4	·28	8·3	
		5	·37	10·4	
		6	·54	12·5	
		7	·65	14·8	
		9	1·0	17·6	
Leoni, Fishtail economizers, No. 3	..	3	·16	5·4	
		4	·25	7·6	
		5	·34	9·6	
		6	·44	11·3	
		7	·56	13·1	
Sugg's earthenware tips, No. 4	..	3	·38	3·8	
		4	·6	4·6	
		5	·92	4·8	
Sugg's earthenware tips, No. 5	..	4	·4	6·9	
		5	·57	7·8	
		6	·74	8·3	
Sugg's earthenware tips, No. 6	..	4	·3	6·9	
		5	·4	9·6	
		6	·55	11·9	
		7	·71	13·0	
Sugg' earthenware tips, No. 8	..	4	·11	8·9	The flame very long and flickering. An increase in consumption caused roaring.
		5	·14	10·9	
Fishtails set in brass, No. 5	..	4	·38	7·4	Roars and flickers.
		5	·5	..	Roars badly.
Fishtails set in brass, No. 6	..	4	·35	6·9	Roars and flickers. Could not burn more gas without further increasing the roaring.
Fishtails set in brass, No. 7	..	4	·3	8·0	
		5	·41	..	Roars badly.

Mr. Leoni furnished a very complete assortment of bat's-wing and fishtail burners for gas of all qualities. Like his Argand burners above mentioned, the tips were made of patent adamas. They gave good flames, with very little noise. Two kinds of these burners were tested, one with the tips set in iron but otherwise like common burners, the other with tips set in brass. The latter contained pieces of wool inside for the purpose of lessening the pressure of the gas before it reached the jet. Besides modifying the effect of any change in pressure in the gas-pipes, this wool appeared of little use. Many burners were tried with and without it, but, when the pressure of the gas was checked at a sufficient distance from the burner by the ordinary stop-cock, it appeared to be useless. The same purpose is served by putting a jet of lower gauge inside the other.

The "Economizers" are two burners so arranged that the jet of one impinges on that of the other at an acute angle. The two jets meet before combustion takes place, and so form one broad sheet of flame. They gave better results, with less flickering than any other burners examined. No. 6 bat's-wing economizer, with a consumption of 8 cubic feet per hour, gave a very fine flame of 19·9-candle power, whilst the No. 8 bat's-wing, No. 8 fishtail, and Paris street-lamp burner gave 16·2, 16·0, and 18·6 candle power respectively, with the same consumption. This, although not equalling an Argand properly constructed for consuming that amount, yet for a cheap burner the result is very good. Consuming 12 cubic feet of gas per hour, it gave a splendid flame with a light only 3-candle power lower than that of a large Argand specially constructed to consume large quantities of gas.

The bat's-wing burner, which the Paris Gas Company is compelled to use in all the street-lamps of Paris, is specially constructed to consume 140 litres (4·94 cubic feet) per hour. Consuming that quantity, it ought to give a light 1·1 times that of the standard moderator. The minimum width and height of the flame must be ·067 and ·032 of a mètre (2·63 and 1·25 inches) when consuming that quantity. An illuminating power of 1·1 times that of the French standard will be 10·63 candles. Taking the result given in the table at 5 cubic feet per hour, and calculating the illuminating power at 4·94 cubic feet, we have 10·76 candles, which is about 1-10th of a candle higher than the number above given.

The results given in the table show that this burner, at a consumption of 5 cubic feet per hour, is superior to all other bat's-wing burners which were tested. Some others gave a light of equal power, but with such an unsteady flame that their use is out of the question. The pressure of gas at the exit was very low, but the shape of the burner admitted this without undue flickering.

Mr. Sugg also sent an assortment of bat's-wing and fishtail burners. It will be seen from the remarks in the tables that those of a higher gauge, from which the best results ought to have been obtained, would not consume more than 5 cubic feet of gas per hour without that well-known noise, accompanied with great agitation in the flame, called "roaring" or "blowing." Even at that consumption, and below, the flames flickered a great deal, and there seemed no intermediate stage between the flickering, which is frequently seen when jets of a high gauge burn small quantities of gas at low pressures, and the roaring or blowing which occurs when the gas issues at too great a velocity for the jet to form a properly shaped flame, which shall draw in regularly the required amount of air.

Experiments on "Carburetted" Gas.

The object of the "Carburettor" is to add to common gas, after it has passed the house meter, a vapour rich in carbon, and of nearly the same chemical composition as the highly illuminating carburetted hydrogen, much of which is destroyed by the high heat which is usually given to the gas-retorts. The common practice of "firing" good gas coal at a high temperature increases, by about 25 per cent., the amount of gas evolved at low heats, but it decreases the illuminating power about 20 per cent. While companies sell their gas by quantity and not by the actual amount of light supplied, they will naturally continue to obtain as large an amount of gas as possible, provided they just keep it up to the standards required by their Acts. Of course there may be other reasons inducing companies to increase the illuminating power of the gas supplied, but it seems to be a rule that the consumer, to obtain a given amount of light, is compelled to use as large a quantity of gas as possible.

The liquid used in the carburettor is the most volatile of the liquids obtained in the manufacture of paraffin oil, and known in commerce under the name of naphtha. It is sufficiently volatile to be taken up in such quantities as to render a poor gas highly illuminating.

Carburettors were sent to the testing-house by Mr. Bower, of St. Neots, Hunts, and by Mr. G. Glover, of Ranelagh Road, Pimlico, London.

That sent by Mr. Bower is large enough for from 5 to 8 lights. After the gas has passed the ordinary house meter it enters the inlet-pipe of the carburettor, and thence passes to the chamber, where it it exposed to a very large surface of the naphtha suspended in wool. Here it takes up the required amount of vapour, and then passes to the outlet-pipe, which is connected with the gas-pipes of the house. There is a tap on the top of the instrument, by which the amount of carburetting can be regulated. The same maker also exhibited a street-lamp carburettor upon the same principle. The top of the lamp-post forms the chamber for the oil. The whole arrangement is very neat, and well adapted to its purpose.

The great advantage in Mr. Bower's carburettors is their simplicity of construction; they cannot get out of order.

In the carburettor of Mr. George Glover, provision is made against the difficulty of obtaining naphtha having a uniform boiling-point. The volatility of most of the naphtha of commerce is very much less after a certain portion has been taken up by the gas; hence, after an ordinary carburettor has been at work for some time, the illuminating power of the gas from it is much lower than at the commencement. This instrument has two chambers—the upper, a reservoir for the oil; the lower, for carburetting the gas. The top supplies the bottom after the principle of the "bird fountain," so no oil passes from the top till that in the bottom has been reduced to a certain level. If, however, the top chamber is not perfectly air tight, the oil fills the bottom, and no gas can pass. This seems a point on which great attention should be bestowed, or some trouble will be occasioned by the total stoppage of gas. The bottom chamber contains spirals filled with sponge, and in these the gas is exposed to the naphtha.

The details of the internal parts of the carburettors of both makers are well adapted for charging the gas with a large quantity of vapour. It was found in each case that gas could be supplied to the number of jets for which the instrument was constructed of a higher illuminating power than could be consumed by the ordinary burners.

The results in Table I. were obtained by the use of Mr. Glover's carburettor, which was fitted with an arrangement which permitted gas to be brought to any required illuminating power.

The consumption of 5 cubic feet per hour, and illuminating power of from 12 to 15 candles, were taken as being about what would be required in ordinary use.

TABLE I.—*Five Cubic Feet of Gas consumed per Hour in each Case.*

Name of Burner.	Illuminating Power to which the Gas was brought by the Carburettor.	Consump. of Naphtha per Hour.	Cost of 1000 Cub. Ft. of Gas with the Naphtha used. Gas taken at 4s. p. 1000, Naphtha at 3s. p. Gall.	Cost of an Amount of Gas necessary to give the same Light as 1000 Feet of Carburetted Gas.
	Candles.	Grains.	s. d.	s. d.
Bat's-wing burner of Paris street-lamps	12·5	35·	4 4½	4 5½
Leoni's No. 6 bat's-wing	12·5	51·7	4 7	4 9½
Sugg's Argand for 14-candle gas	15·5	73·5	4 10	4 6½
Sugg's Argand for 16-candle gas	15·5	105·	5 2½	4 6½
Sugg's Argand for 18-candle gas	15·5	160·	6 10	4 9½
G. Glover and Co.'s special burner for carburetted gas	28·6	444·5	9 0½	8 6½

As regards cost, these results show with one exception an advantage in using an increased quantity of common gas instead of the carburetted gas. Thus the Paris street-lamp burner, consuming 5 cubic feet per hour of Paris gas, gives a light equal to 10·9 candles, calculating gas at 4s. per 1000 cubic feet, and oil at 3s. per gallon, the total cost of 1000 cubic feet of carburetted gas, to give 12·5-candle power, at the same consumption, is 4s. 4½d., while the cost of gas alone to give the same amount of light is 4s. 5½d., showing an advantage of ½d. per 1000 cubic feet in favour of the carburettor. In all other results the advantage is on the side of an increased quantity of gas.

Sufficient has been given in this table to enable one to calculate the relative costs in the two cases, whatever may be the prices of the gas and oil. Thus, suppose the price of gas is 5s. per 1000 cubic feet, and oil 2s. per gallon, taking the result from Sugg's 16-candle Argand, we have—

Cost of increased light as obtained from naphtha = ⅜ of 1s. 2½d. = 9½d.
Cost of increased light as obtained from gas = ⅜ of 6½d. = 7½d.

still showing a result in favour of gas.

These results apply only to 12½-candle gas, but they seem to prove that, in ordinary circumstances, there is no advantage in using the carburettor except suitable oil can be obtained at a trifling cost, or the gas is both very poor and very dear.

The results of Table II. were obtained from the carburettor of Mr. Bower. The gas was regulated to 5 cubic feet per hour, as nearly as possible, and the amount of carburetting so arranged as to give approximately the desired illuminating power.

The register of the meter and the weight of the carburettor having been taken, the gas was lighted and allowed to continue burning for about nine hours in each of two experiments, and about twenty hours each in the

others. At intervals during these periods the meter was adjusted, and the illuminating power of the flame taken. The results given are the averages.

TABLE II.—*No. 4 Bat's-wing Burner, consuming 5 Cubic Feet per Hour.*

Series of Experiments.	Consumption of Gas in Cubic Feet.	Consumption of Naphtha in Grains.	Average Illuminating Power.	Illuminating Power of best Bat's-wing Burner without Carburetting.	Increase due to Naphtha.	Grains of Oil per Cubic Foot for each Candle Power of Increased Light.
1	97·4	6006	24·3	10·9	13·4	4·6
2	48·	1262	16·2	10·9	5·5	4·7
3	45·	816	15·0	10·9	4·1	4·4
4	106·3	1186	13·7	10·9	2·8	3·96
			From Table I.	Paris street-lamp burner.	4·1	
				Sugg's 14-candle Argand.	4·9	
				Sugg's 16-candle Argand.	7·0	
				Sugg's 18-candle Argand.	10·6	
				Glover's special burner	5·5	

From the last column it appears that the amount of naphtha consumed per foot of gas, for each candle power of increased light, depends more upon the burner than upon the extent to which the gas is carburetted. There appears to be no advantage, as regards the light obtained from a given weight of oil, in increasing the consumption, as is the case with gas.

From calculation, taking the above prices of gas and naphtha, it would appear that if less than 5·6 grains of oil were consumed per cubic foot for each candle power of increase in light, there would be an economy in using the carburettor; but it must be remembered that the illuminating power of a flame increases much more rapidly than the increase in consumption; 8 cubic feet per hour, burned in proper Argands, gives double the light of 5 cubic feet; so, if the light be brought up to 25-candle power by the carburettor, less than 3·36 grains should be consumed per foot for each candle power of increased light. But this number is much below any result obtained.

Experiments on Scholl's Patent Platinum Light Perfecters.

These perfecters, manufactured by Mr. Scholl, of 41, Berwick Street, Oxford Street, London, are little rings of brass, carrying a small plate of platinum, about 4-10ths of an inch long by 1½-10th wide. The rings fit on the top of either fishtail or bat's-wing burners, and support the platinum in a vertical position, so that the gas, as it issues from the burner, is divided into two parts in the direction of the flat surface of the flame. They appear best adapted for fishtail burners. With these the two jets of gas, instead of impinging one on the other, impinge on the two sides of the platinum, and unite above to form the flame. The increase of light is very striking when the perfecter is placed on a jet of small bore, supplying gas at a high pressure. The effect, however, decreases as the pressure decreases, or, what is equivalent, as the gauge of the openings increases. This gives an explanation of the action of the perfecter. The gas impinging on the sides of the piece of platinum, loses part of its velocity, and, consequently, the amount of air drawn into the flame by the jet is lessened.

The following table shows the increase of illuminating power due to the perfecter when used on burners of various gauges:—

Kind of Burner.	Cub. Feet of Gas per Hour.	Pressure in Inches.	Illuminating Power. Without Perfecter.	Illuminating Power. With Perfecter.	Increase p. cent.	Remarks.
Leoni's No. 2 fishtail	3	0·84	1·3	4·1	215	
Leoni's No. 3 fishtail	3	0·46	2·4	4·6	91	
	4	0·7	2·8	6·5	132	
Leoni's No. 4 fishtail	3	0·31	3·4	5·0	47	
	4	0·47	4·5	7·6	08	
	5	0·71	5·0	9·2	84	
Leoni's No. 5 fishtail	4	0·42	5·3	6·9	30	
	5	0·6	6·1	8·3	36	
	6	0·81	7·1	10·0	40	Flame flickers.
Leoni's No. 6 fishtail	4	0·31	6·2	8·0	29	Flame flickers.
	5	0·46	8·0	10·4	30	Flame flickers a great deal.

The flames from the No. 6 burner with the perfecters flickered too much for ordinary use when consuming 5 cubic feet per hour. With burners above this gauge this flickering increased; in fact, the perfecters narrowed and heightened the flame just as an increase in the size of the holes of the burner would have done, and it appears that the increase of light due to the perfecter may be obtained by simply enlarging the size of the openings through which the gas issues. This size is limited by the flickering of the gas, for the jet must escape with sufficient velocity to give a proper form to the flame. The use of the perfecter is limited in the same manner, and it appears that no more light can be obtained from a given quantity of gas by the use of a perfecter than by the use of an ordinary burner of the proper shape and gauge of opening to suit the consumption and quality of the gas.

On comparing the results from fishtail burners with the results just given, it will be found that, with consumption of 5 cubic feet of gas per hour, a No. 6 burner, with the perfecter, gives the same light as a No. 7 or No. 8 burner without the perfecter.

Results of Experiments on Stoves for Heating Water by Gas.

These results were obtained by boiling a measured quantity of water in a tin kettle over the flames of the stove. Observations were made of the temperature of the water at the commencement, the amount of gas consumed, and the time from the application of the light to the boiling of the water.

In every case the apparatus was perfectly cold before starting. Care was taken to keep the room free from draughts, but otherwise the stoves remained just as in ordinary use.

In the experiments, the results of which appear in Table I., 2 litres of water were contained in a kettle of appropriate size and ordinary shape. In those of Table II., the kettle contained 4½ litres of water, and had a much larger bottom in proportion to its size; it was one such as is used for boiling on the hot plates of cooking-ranges.

In all cases the time and consumption of gas have been calculated for water at 15·5° Cent.

TABLE I.

Name.	Time taken to boil 2 Litres of Water at 15·5° Cent.	Amount of Gas consumed.	Number of Kettles of Water which can be boiled for One Penny with Gas at 4s. per 1000 Cub. Feet.
	Min.	Litres.	
Schaeffer and Walcker (*a*)	20·	62·2	9·
Schaeffer and Walcker (*b*)	16·5	57·7	9·8
Leotard's, both rings	15·	97·7	6·4
Leotard's, centre ring	20·	64·0	8·7
Phillips' atmospheric	19·	57·2	9·9
Leoni's large	11·	68·2	8·3
Leoni's small	15·	60·	9·4
Bengel's (*a*)	24·	66·5	8·5
Bengel's (*b*)	23·	62·3	9·
Bengel's (*c*)	32·	60·3	9·4

TABLE II.

Name.	Time taken to boil 4½ Litres of Water at 15·5° Cent.	Amount of Gas consumed.	Number of Kettles of Water which can be boiled for One Penny with Gas at 4s. per 1000 Cub. Feet.
	Min.	Litres.	
Schaeffer and Walcker (*a*)	37·5	127·3	4·4
Phillips' rings	27·5	215·1	2·6
Leoni's large stove	20·5	136·	4·1
Leoni's large stove, at low pressure	27·	127·5	4·4
Leotard's	24·5	155·1	3·6

1000 litres (1 cubic mètre) of gas are 35·31 cubic feet.
Two litres of water are 3·52 pints.
Four and a half litres are 7·9 pints.
The average price and quality of London gas have been taken. In Paris the cost would be nearly double.

The "atmospheric burner" attached to Phillips' gas-cooking apparatus consumed the least quantity of gas in boiling 2 litres of water, but the time taken was greater than that by some others. Messrs. Schaeffer and Walcker's (*b*) took 1 per cent. more gas, but 13 per cent. less time; hence the advantage between these two seems to lie with the latter. Again, the small stove of Mr. Leoni took about 5 per cent. more gas, but 21 per cent. less time, and his large stove about 20 per cent. more gas and 42 per cent. less time.

The saving of gas as against the saving of time may be looked at in this way: Using Phillips' burner in preference to Leoni's large stove would effect a saving of one penny on 50 kettles of water, whereas the time lost would be 6 hours 40 minutes.

Description.—These burners are all adapted for boiling water or vegetables, stewing, and frying. They are all simply modifications of Bunsen's burner, in which a certain quantity of air is allowed to mix with the gas before it reaches the point at which it burns. If this amount of air be too great the mixture reaches the exploding point, and the flame runs down from the proper burner and burns at the point of exit of the gas within the tube, which should carry the mixture of gas and air. This is the great objection to the use of the ordinary Bunsen's burner, in which this tube is vertical. If, for instance, one wishes to boil a vessel of water quickly, and afterwards allow it to simmer, he will first of all turn on a full supply of gas, and then turn it down very low; but the apparatus having become hot, the upward current will give more air than ought to be mixed with the gas, consequently the flame will run down as before described, and not only give off very bad fumes and smoke, but perhaps dangerously heat the whole apparatus.

This difficulty is got over by many makers by arranging horizontally the tubes for carrying the gas and the mixture of air and gas. By this arrangement the air is drawn in solely by the jet of gas issuing into a horizontal tube opened at both ends, just as buildings are ventilated by compressed air. The amount of air mixing with the gas will be in proportion to the amount of gas discharged; so if the apparatus is arranged for admitting the required amount of air at a given consumption, the proper quantity, or very nearly so, will be drawn in at any other rate.

Schaeffer and Walcker, Berlin.—The stove of this maker, marked (*a*), is an ordinary arrangement of three upright Bunsen's burners fitted to a heavy stand, with a support for any vessel at the top. This is subjected to the disadvantage spoken of above.

That marked (*b*) has the horizontal arrangement of the pipes for carrying the gas and mixture of gas and air. This latter pipe discharges itself into a hollow *chamber*, circular in its horizontal and elliptical (flat) in its vertical section. On the upper part of this burner are a number of holes, about 3 millimètres, or 1-8th of an inch in diameter. At these holes the gas burns. The burner is carried on a common circular support with four short legs. The total height of the stove is not more than 4½ inches.

The largest sizes of these stoves need not be constructed more than 4 inches high. This is an undoubted advantage over the others in point of stability.

Many experiments were made to try if the flame would run down and burn within the tube; but with the smallest amount of gas the flame remained at the burner, while with the largest amount the flame did not become yellow from a lack of air.

M. Leotard's, Paris.—This is also a horizontal arrangement. It differs from the above in having two horizontal pipes, each independent of the other, and having its own stop-cock. One of these supplies an inner ring, and the other two outer rings of holes in the burner. This arrangement gives either a large ring of flames, as required for frying, &c., or a smaller one, as for keeping up a gentle heat under a stewpan.

The height of this stove is not more than 4 inches. The results obtained from it were not so good as those from Schaeffer and Walcker's. It appeared that this particular one did not admit a sufficient supply of air.

Phillips' "Atmospheric Burners."—These formed part of a very complete little stove for roasting, baking, boiling, &c., which has been reported on under "Cooking Apparatus." They are the ordinary Bunsen's burners, modified both at the inlet for the air and at the top where the gas burns.

Leoni's, St. Paul's Street, New North Road, London.—These stoves are made in two parts—a bottom chamber for regulating the admission of the air, and an upper where the air and gas are mixed. The gas is discharged into the bottom of the latter, which is a hollow vertical cylinder, 7 inches long and of about 1 inch in internal diameter. This cylinder expands at the top into a kind of funnel of 4 inches diameter, closed by a disc having in it three holes of three-quarters of an inch diameter. These holes are fitted with little hollow cylinders of Leoni's patent adamas, about half an inch high and half an inch in internal diameter. These form three burners for the mixture of air and gas, and, being bad conductors of heat, the body of the stove remains quite cool.

Bengel's Burners are the ordinary Bunsen's burners, fitted at the top with a hollow disc of brass, from the edge of which the gas burns in a continuous ring. Some have also two slits at right angles across the top, giving two lines of flame. They were arranged for chemical, and not for domestic purposes.

In Table II. the results of experiments on another part of Phillips' stove are given. This was constructed of ordinary rings of iron tubing pierced with little holes, and no air was mixed with the gas before combustion. The results show how much is gained in heating power by mixing air with gas, but it must be stated that this part of the stove is specially made for frying under the rings, as well as for boiling water above.

Captain Donnelly's Arrangement for Lighting Fires without Wood or Paper.

This consists of two Bunsen's burners, one attached to each side of the grate. The pipes carrying them are jointed, to admit of the flames being concentrated on any point and in any direction. To light a fire the coal is laid in the ordinary way, and the flames allowed to play upon it in the centre of the grate. When the coal is fairly lighted the gas is turned off, and the burners turned back out of the way. Such an arrangement necessitates a pair of burners to each grate; but another arrangement exhibited is supported on a small moveable stand, the gas being supplied by a flexible tube, which can be attached to a cock at any convenient place near the grate, and removed after use. Thus one pair of burners serves for a whole house. The following are the average results of several experiments. In every case the fire was burning brightly when the flame was removed:—

Time taken.	Consumption of Gas.	Number of Fires which can be lighted for One Penny, taking Ordinary Gas at 4s. per 1000.
11 minutes.	2·64 cubic feet.	8 nearly.

Experiments on Lamps, Candles, &c.

These experiments were conducted on a Bunsen's photometer lent by Mr. G. Glover. At one end the standard candle was carried in a socket above one of the arms of the beam of an accurate balance, so that weighings could be made without removal. At the other end the lamp was counterpoised on a balance which turned readily with a weight of 2 grains when carrying 4 pounds.

After the lamp and the candle had been burning about half an hour, the lamp was set as nearly as possible to the required candle power; both were then counterpoised, and the illuminating power of the lamp taken at regular intervals. At the end of an hour the amounts consumed were ascertained, and the consumption of the lamp calculated for the illuminating power at which it had been intended that it should have burned. Each result given in the table is the average of two or three hours observations.

TABLE I.—*Paraffin Lamps, the same Oil throughout.*

Name.	Illuminating Power at which the Lamp was set.	Grains of Oil per Hour.	Number of Hours Light for One Penny, taking Oil at 2s. 6d. per Gal.
Young's (No. 5)	4·	227	8·7
Stobwasser's (flat wick)	4·5	385	5·1
Rowath's (small lamp)	5·	280	7·0
Marmet's (small round wick)	6·	290	6·8
Marmet's (flat wick)		309	6·6
Young's (flat wick)		310	6·4
Ives' (large lamp)		310	6·4
Young's (smaller flat wick)		314	6·3
Young's (another size)		316	6·3
Rowatt's (large lamp)		317	6·3
Sullivan's (Aladdin)		356	5·9
Stobwasser's (small round)		353	5·6
Stobwasser's (large round)		400	4·9
Marmet's (disc above wick)		407	4·9
Marmet's (disc taken off)		413	4·8
Marmet's (disc changed in height)		439	4·5
Brown and King's (disc above wick)		504	3·9
Sullivan's (disc above wick)		568	3·5
Young's (round)	8·	381	5·2
Rowatt's (large)		384	5·2
Young's (flat)		400	4·9
Stobwasser's (small round)		491	4·1
Ives' (large)	9·	439	4·5
Marmet's (large disc above wick removed)	10·	480	4·1
Young's (large round)		491	4·0
Sullivan's (Aladdin)		504	3·9
Stobwasser's (large round)		517	3·8
Marmet's (disc lamp)		607	3·2
Sullivan's (disc lamp)		723	2·7
Marmet's (without disc)	14·5	607	3·2

TABLE II.—*Paraffin Oil Lamps, with Maker's own Oil.*

Name.	Consumption per Hour per Candle Power.*	Retail Price of Oil taken for the Next Column of Figures.	Number of Hours Light of 1 Candle Power for One Penny.
	Grs.	s. d.	
Sullivan's, with "Dimantine"	57·6	..	—
Young's, with paraffin oil	54·9	2 6 per gal.	35·8
Brown and King's, with "burning liquid"	61·6	6 0 ,,	14·2

* Average at 6, 8, and 10 candle power.

Experiments on Candles.

Name.	Consumption per Hour in Grains.	Illuminating Power calculated for a Consumption of 120 Grains per Hour.	Retail Price per Pound.
			s. d.
Wilkie and Soames' "stearaffin"	123·4	1·15	1 0
Wilkie and Soames' "Greenwich sperm"	134·	1·13	—
Young's hard paraffin	110·	1·1	1 3
Field's paraffin	120·5	1·1	1 3 (?)
Young's hard paraffin, another quality	111·6	1·09	1 3
Wilkie and Soames' "stearaffin" another quality	138·	1·05	(?)
M. Weiss' (Lyon) stearic, large	141·	·79	1 0
M. Weiss' (Lyon) stearic, small	117·	·68	1 0

This table contains trials of all the candles which exhibitors would give for the purpose. In most cases the request for specimens was refused.

TABLE III.—*General Table, showing the Comparative Costs of Illuminating by Gas, Oils, and Candles.*

Substances, and how burned.	Prices taken for Calculation.	Number of Hours of Light obtained for One Penny per Candle Power.
Gas, burned from a proper Argand burner, averages at 10, 12, and 14 candle power	4s. p. 1000 cub. ft. of 12·5-cand. gas.	51·6
Gas, burned from the best bat's-wing burners, averages at 6, 8, 10, and 12 candle power	do. do.	44·6
Gas, burned from the best fishtail burners, averages at 6, 8, 10, and 12 candle power	do. do.	43·3
Paraffin oil averages at 6, 8, and 10 candle power, burned in an ordinary lamp	2s. 6d. per gal.	38·4
Colza oil, burned in a moderator at 9·6-candle power	4s. 6d. do.	17·5
Colza oil, burned without a chimney with a common flat wick	do. do.	11·5
Paraffin candles, Young's	1s. 3d. per lb.	4·26
Paraffin candles, Field's	do. do.	4·26
Stearaffin candles, Wilkie and Soames'	1s. do.	5·65
Stearine candles, French manufacture (Weiss, Lyon)	do. do.	3·3
Sperm candles (those used for standard)	1s. 6d. (?) do.	3·24
"Dimantine" oil, Sullivan's		—
"Burning liquid," Brown and King's	6s. per lb.	14·2

PUBLIC LIGHTING IN THE CITY OF LONDON.—At the last meeting of the Commissioners of Sewers, tenders were opened for lighting the public lamps in the City with gas for the remainder of the year. The tenders of the Chartered Company at £5 1s. per lamp per annum, for the northern district, and the Great Central Company at £4 17s. 6d. per lamp per annum, for the southern district, were accepted.

GAS EXAMINER TO THE CORPORATION OF LONDON.—The Gas Committee have selected from the candidates the names of Mr. Heisch and Dr. Whitmore to be submitted to the Court of Common Council for the final choice to be made. Dr. Redwood retired previously to the selection being made.

A FIFTY-GUN FRIGATE LIGHTED WITH GAS.—In a letter addressed to one of the London daily papers, Commander Pocock, R.N., says: "As the *Wellesley*, training ship, is the first ship illuminated with gas, it may interest your readers to know that it is a perfect success. It is conveyed under water by means of elastic tubes. There were many difficulties to be overcome, and Mr. Little, of Newcastle, deserves great credit for the manner in which he has performed a very difficult task. I see no reason why we should not have manufactured it on board, as is to be done in Her Majesty's ship *Monarch*; but, the gas being within 200 feet, it was thought best to bring it from the shore."

EXPLOSION OF GAS IN OXFORD STREET, LONDON.—On Monday night, Jan. 25, an explosion of gas took place in the premises of Mr. T. J. Coles, milliner and artificial florist. The bed, bedding, window curtains, and other articles in the back room of the first floor, were set on fire by the explosion. The engines attended, and the fire was soon extinguished. An inspection was then made of the premises, the damage being officially reported as follows:—"No. 206, Oxford Street, Mr. T. J. Coles, milliner: cause of fire, explosion of gas; contents insured in the Royal and Scottish Imperial Offices; damages, bed, bedding, and window curtains, back room, first floor, damaged by fire. The shop and skylights on ground floor, and also the back windows on first and third floors, with the contents, severely damaged by explosion." It is not a little singular that, although the ground and third floors were so shattered, the second floor received no injury whatever.

SERIOUS GAS EXPLOSION AT NORWICH.—Between six and seven o'clock on Sunday morning, the 24th ult., a gas explosion occurred at Clifton House, Albemarle Road, Norwich, the residence of Mrs. M. A. Selwyn. On the previous night the meter was not turned off, and when the servants came downstairs on Sunday morning they found that there was an escape of gas from a slide chandelier, in the dining-room, having fallen down in the course of the night. The housemaid opened the window, and took other necessary precautions to prevent an explosion; but in the course of about ten minutes, believing that there was no danger, she was proceeding down the hall towards the kitchen, with a lighted candle in her hand, when a serious explosion took place. She was violently thrown down, and a child was forced out of bed by the shock. The walls were pressed forward some inches. The windows were entirely blown out, the doors were scorched, and the chairs and tables burnt. Neither the chandelier nor the glass ornaments in the dining-room were injured; but four oil paintings were destroyed. A large oak dining-table was projected through the window a distance of some six or seven feet; but, fortunately, none of the inmates of the house were much injured.

DESTRUCTIVE FIRE.—A fire, proving the necessity for the Act relating to the storage of petroleum, &c., which came into operation yesterday, occurred in South Street, Exeter, on Saturday. A man named Miller dealt largely in benzoline, petroleum, &c., and exhibited the relative brilliancy of these several oils by putting lighted lamps in his front window. About one

o'clock p.m. there was an explosion in the wareroom, where quantities of benzoline, petroleum, and paraffin were stored, and immediately afterwards the whole premises were enveloped in flames. The wife of the proprietor was obliged to jump out of window to save her life, and the children were with some difficulty taken out of the house. The flames spread so rapidly that within a very short time the premises were completely gutted, and the adjoining houses, occupied by a cheese dealer named Toby and an innkeeper named Southcott, were very much damaged. A large quantity of property was consumed, and it was not until several hours had elapsed that the engines belonging to the various insurance offices succeeded in extinguishing the flames.

Gas Lighting at Boston, U.S.A.—At a meeting of the Board of Aldermen, held on the 2nd ult., a communication was received from Mr. F. E. Stimpson, state inspector of gas-meters, in compliance with an order of the board, dated Nov. 23, in which he stated that he found the gas supplied by the South Boston, East Boston, and Roxbury Gaslight Companies well purified. The gas supplied by the Boston Gaslight Company was well purified until the 16th of December last, but since that time it had been charged with sulphuretted hydrogen. He found the illuminating power, in all cases, to be above the standard required by law—viz., 12 candles. East Boston, 15 candles; South Boston, 17 candles; Roxbury, 17½ candles; Boston, 18 candles.

Average Composition and Quality of the Metropolitan Waters in January, 1869.—The following are the returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Comps.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	20·77	0·158	0·255	0·001	14·8	5·2
West Middlesex	20·37	0·167	0·204	0·004	14·6	5·3
Southwark and Vauxhall	21·93	0·198	0·219	0·007	14·6	5·2
Chelsea	21·03	0·173	0·168	0·008	14·8	5·3
Lambeth	20·19	0·180	0·231	0·004	14·0	5·2
Other Companies.						
Kent	28·00	0·040	0·258	0·006	20·8	6·7
New River	22·43	0·107	0·240	0·005	16·4	4·8
East London	24·47	0·107	0·300	0·002	16·3	4·8

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and, in the case of the metropolitan waters, the quantity of organic matter is about eight times the amount of oxygen required by it.

All the Thames waters, excepting the West Middlesex, were slightly turbid when drawn from the companies mains. H. Letheby, M.B.

Register of New Patents.

976.—Julius Brönner, of Frankfort-on-the-Maine, in the kingdom of Prussia, manufacturer, for "*Improvements in the construction of gas-burners.*" Patent dated March 23, 1868.

The nature of this invention consists partly in providing for the more profitable consumption of gas, and partly in the prevention of faults appertaining both to ordinary gas-burners and to those previously invented by the present inventor.

The upper part of the gas-burner—in other words, the burner-head—in which is the opening for the jet or flame, is constructed so that the outside is concave or funnel-shaped, whilst the inside may be convex, concave, conical, funnel-shaped, or flat. In this upper part of the burner a slit is made, the length and breadth of which is regulated by the consumption which is to be given to the burner. The effect of this is that the gas flows from both ends of this slit towards the middle; both streams consequently meet in the centre and flatten, thereby producing a flame standing at right angles to the slit, contrary to the effect produced in the slit burners hitherto used, in which the gas, flowing out in every direction given to the slit, forms a flame burning in the shape of such slit.

The effect above described is obtained by the application of a slit in the hollowed or sunken burner-head, and whether the chamber or body be made more or less deep, or whether the slit be of greater or less depth, with either horizontal or vertical sides, is of no great importance, neither does the material of which the burner is made in any way influence the result, and the whole effect produced by such modifications consists in inappreciable disfigurations of the flame, which will become more pointed, broader, more regular, or more irregular. The patentee therefore expressly reserves to himself all these variations in the construction as well as the choice of the material, be it "speckstein," clay, or steatite, porcelain, brass, iron, or any other substance.

The utility of this construction is, that while avoiding the faults of the ordinary two-hole fishtail and of the slit bat's-wing burner, it unites all their advantages, viz.:—

1. This new fishtail slit burner produces the beautiful jet or flame of the hole burner, whilst the long points of the ordinary slit burner jets disappear; consequently it becomes possible to make use of a glass globe or other apparatus for protecting the flame.

2. It prevents the hissing or singing of the flame which takes place in hole burners under increasing pressure.

3. It resembles ordinary slit burners in not being exposed to the choking of the burning aperture by the impurities of the gas, as is the case with hole burners.

The application of this new construction to single (not compound) burners explains itself; in compound ones (double or economic burners) it is applied by employing the single fishtail slit burner as under burner, by using a large fishtail slit burner as head, or by setting the head of a fishtail slit burner on or in the body of the economic burner.

988.—George Bertie Paterson, of 15, Arnold's Place, Francis Street, Walworth, in the co. of Surrey, machinist, for "*Improvements in gas-meter indexes.*" Patent dated March 24, 1868. (This patent is void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.)

The object of this invention is to allow consumers of gas to have a safe index, easily read, and not liable to be put out of order. The index is in like manner beneficial to gas companies, as it cannot be tampered with.

The nature and description of this invention consists in having three or more revolving dials, with figures from 0 to 9 marked near the edge or rim thereof. The right-hand dial represents hundreds, the second or centre dial thousands, the third dial tens of thousands, and so on in like decimal proportion for every other dial that would be added on the left, in the usual manner of ordinary indexes. For small meters three dials are used, the centre dial being placed behind the others and partly covered by them, the rims of the side dials being brought nearly together. When four dials are used the left dial would be placed partly behind the third dial, a fifth dial partly before the fourth, and so on, alternately placing one dial partly before or behind the other, in order to bring their edges respectively close to each other, but always leaving the top figure on each dial clear. Each of the dials has a spindle worked at both ends into a metal frame. Upon each of these spindles (excepting the last on the left) are fitted two wheels, one having one notch or tooth on its edge, and the other ten notches or teeth, both wheels revolving together. The wheel with one notch or tooth works the neighbouring wheel of ten notches or teeth, and causes it to revolve once to every ten revolutions of the one-toothed wheel, and so on to each of the other wheels in succession, the last spindle on the left having only one wheel with ten notches or teeth. On the right of all the dials is fitted another spindle, having a wheel with one notch fitted thereon that works into the adjoining wheel of ten notches or teeth. On the same spindle is worked an eccentric cam, with a lever and friction-roller to ride over it, and as the cam revolves the lever drops down in its place and prevents the machinery from being reversed. The index is sometimes made with three wheels on each spindle instead of two (excepting to the spindle on the extreme left, which would have only two wheels). One of the wheels has only one notch or tooth on its edge, and one pin by the side of the notch; the other two wheels have ten teeth in each, one wheel being rather less in diameter than the other, and into which the notch or tooth of the first wheel works whilst the pin simultaneously acts against the teeth of the larger wheel, and revolves the same one-tenth. The other wheels are acted upon in like manner in the decimal proportion herein described. Action is given to both or either of these indexes in the usual manner by a shaft from the meter with endless worm and pinion wheel, and a drum or dial should be fitted at the top with pointer to show the number of feet of gas that has passed through the meter. The index is enclosed and attached to the meter, and is covered in front with a piece of glass blackened or otherwise obscured at the back, excepting where it covers the top centre figure of the dial, such parts of the glass being left transparent, as well as the part over two ciphers marked on the right of the other figures to make up the complement and denote the quantity of gas that has passed through the meter, the whole of the figures seen being read off in one line. All the other figures of the dials are out of sight.

1046.—Stephen Holman, of 10, Laurence Pountney Lane, in the City of London, engineer, for "*Improvements in the construction and application of steam-pumps, parts of which improvements are also applicable to other pumps, blast-engines, exhausters, and other machines; also improvements in hydraulic lifts and the mode of working the same.*" Patent dated March 27, 1868.

This invention relates, firstly, to a novel construction of steam-engine and pump-cylinders, by means of which a very simple, cheap, and efficient steam-pump is produced. The steam-pump consists of a cylinder having a central division either cast or inserted therein; a hole is made in the central division through which a parallel connecting-piece passes, and to which two pistons are fitted, which two pistons work in the cylinder, one on either side of the central division; the two pistons are operated by means of steam acting alternately on their outer surfaces nearest the cylinder ends, and close to the central division two passages are formed, and a valve-chamber is constructed or attached in close proximity thereto, the valves of which are operated by the inner surfaces of the pistons alternately, by which means a constant ingress and egress of water or other fluids will be effected.

This invention relates, secondly, to a novel method of operating the steam slide-valve. In order to effect the necessary movement of the slide-valve at each traverse (of the pistons) or each half stroke of the engine, each cylinder-cover is constructed with a cavity or chamber, each having a passage communicating with the piston-ends of the slide-valve. Through the inner side of the chamber one or more holes are made opening into the ends of the cylinder; in these holes moveable plugs or plungers are fitted, with their ends protruding any determined distance into the cylinder. After the plugs are put in their places, there is placed over them a piece of india-rubber or other suitable material, and the rubber being secured between two flanges, or by any other convenient method, the chambers in the covers are either filled or partly filled with water or other fluid. When either piston which is acted upon by the steam forces the other piston towards the end of the cylinder, such piston so forced will come in contact with the moveable plug or plugs, and force it or them into the chamber in the cover, and thereby displace a sufficient quantity of water, or so compress an elastic material or fluid, as to move the slide-valve and reverse the stroke of the pistons. By the repetition of this process at each end of the stroke, a reciprocating action will be effected without any external mechanism whatever.

This invention relates, thirdly, to a novel construction of buffer-valves, seats, and stops, which are designed with a view to obtain an increase of speed, and thereby to increase the relative duty of steam and other pumps. This important object is effected in the following manner—namely, round disc-shaped valves of metal or other suitable material are made with a hole through a central boss to work on a guide-rod; on the guide-rod, immediately above and embracing the boss of the valve, is placed a tubular buffer or stop of india-rubber or other suitable material (the dimensions of which are quite arbitrary); the said buffer is contracted at the extreme end above the valve, so as to embrace the guide-rod; suitable stops are provided, so that when the pump lifts the valve the buffer (or buffers, as the case may be) becomes compressed, and prevents too great a rise of the valve, and also causes the valve to close quickly at the reverse of the stroke.

This invention relates, fourthly, to a novel method of constructing and arranging and working hydraulic lifts by the direct action of water transmitted by the steam-pump before described. Two or more ordinary hydraulic cylinders and rams are placed in any required position, either side by side or at a distance from each other or above each other. The cylinders are connected by means of a communicating-pipe, in which suitable stop-cocks or valves are placed; the cylinders are then filled with water, and force in sufficient water to raise one ram with its platten to the height at which it is determined to raise the goods, or from which it is determined to lower the goods. When the lifts are required to be used for

raising goods, the engine or pump draws the water from one cylinder having its ram run out, which is assumed to be without a load, and forces it into the other cylinder, which has a load on the table or platten, and thus raise it to the height required. By simply shifting the position of the valves the water will be forced in the direction of the other cylinder, and by the repetition of this operation each lift will be raised with its load alternately; but when the apparatus is used for lowering goods only, the use of the pump may be dispensed with entirely during such operation, a single stop-cock being all that will be needed to effect the alternate descent of the loaded tables or plattens. It will be obvious that by turning the stop-cock so as to shut off the communication from one cylinder to another until the upper table is loaded, and then opening it, the loaded table will descend and raise the empty table at the same operation; this alternate stopping of the communication and loading the upraised platform, will give ready facility for lowering goods without the aid of the engine or other machinery.

1056.—William Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in engines for obtaining motive power by means of steam, air, gases, or fluids.*" A communication. Patent dated March 27, 1868.

This invention consists of a peculiar arrangement of motive engine or machine, the characteristic features of which are—

1. The whole of the moving parts are grouped around its central axis.
2. The cylinder has a rotary motion, and inside this cylinder twin pistons have an alternating motion.
3. A novel arrangement of supplying the steam.

This improved engine may be worked by means of vapours, gases, or liquids under pressure, and may be applied to industrial and manufacturing purposes; also for propelling vessels and working pumps; also for propulsion upon railways and common roads, and for any other tractive purposes. As this engine is susceptible of various modifications in its construction, a general description of one arrangement will be here given, so as to set forth clearly the principle of construction. An iron shaft or axle, cranked at a certain distance from the point where it is firmly held, passes between two pistons united by cross-pieces, which hold them rigidly between the two hinder faces of those pistons, and upon the arm of the crank or cranks is a bowle or other suitable intermediate piece between the pistons and the crank-arm. Two segments or half cylinders of cast iron are set upon the said pistons, and are united by enclosing the shaft in brass bearings, so as to form only a single cylinder, which then encloses the above-described parts. Concentrically to the axis upon one or both sides of the cylinders is a kind of steam-box, carrying the induction and eduction pipes, and a semicircular plate or a suitable piece, as slide-valve, adjusted in this box, serves to close the induction orifice more or less. Lastly, the engine is provided with a fly-wheel, which, according to the arrangement or application of the engine, is carried either by the cylinder or by the twin pistons, as will be understood by the description of the drawings.

The following is the mode of operation of the engine:—The central shaft or axle being held fast at one or both ends upon a framing, or otherwise, and its arm (forming the fulcrum of the pistons) being in an eccentric position, the motive power (air, gas, vapour, or liquid) acting on the interior of the ends of the cylinder and upon the pistons causes the cylinder to rotate and impart during this time a reciprocating motion to the pistons.

The induction of the motive agent is effected as follows:—Upon the face or faces of the cylinder, and connecting the steam box or boxes, are orifices, which pass when the engine is brought to its starting-point, or when it is in motion, before the feed orifices leading to the opposite box or boxes; induction and eduction then take place at suitable intervals by means of the slide-valve piece, which may be moved at pleasure. The cut-off to the cylinder may be effected at any point of the stroke.

1059.—Walter Watson Hughes, of 48, Porchester Terrace, in the co. of Middlesex, for "*Improvements in propelling vessels and in forcing water.*" Patent dated March 27, 1868.

In this case a wheel or turbine is employed mounted on an axis driven from a steam-engine, or in other convenient manner. The water is taken in at the centre of the wheel around the axis, and is thrown off at the periphery by the action of inclined blades or arms, with which the wheel or turbine is furnished. The wheel or turbine is enclosed in a casing concentric with it, and of such a size that an annular space is left around the wheel or turbine of an area equal to or greater than the area of the periphery of the wheel or turbine from which the water is thrown off. It is preferred that the discharge pipe or pipes should be of the same sectional area as the casing, but the area of the discharge pipe or pipes should in most cases be as large as the area of the periphery of the wheel or turbine.

1066.—Charles Joyner, of Birmingham, in the co. of Warwick, manufacturer, for "*Improvements in water-slide gaseliers.*" Provisional protection only obtained. Dated March 28, 1868.

This invention consists, first, in adding to the top of the sliding tube of the gaselier a glass vessel open at bottom and top, and joined water-tight at its bottom to the expanded top of the sliding tube. The said vessel is fitted to the expanded top of the tube by the edge of the latter being burnished over a flange at the base of the said vessel, a washer of vulcanized india-rubber or other soft material being placed between the glass and metal. As the level of the water can be seen through the glass vessel, it is known by simple inspection of the gaselier when it requires water.

The invention consists, secondly, in fixing a shoulder at the bottom of the fixed tube of the gaselier, and forming a shoulder at the top of the sliding tube. Should the chain of one of the balance-weights break, the sliding part of the gaselier cannot pass from off the fixed tube.

1070.—William Robert Lake, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*Improvements in filters.*" A communication. Patent dated March 28, 1868.

The object of this invention is to utilize for filtering purposes the bone-dust that has hitherto been of but little value, and this object is accomplished by mixing the bone-dust with fine anthracite coal, or other similar substance or material that is insoluble in the liquid to be filtered, and remains unaffected under the conditions of heating, washing, and steaming to which it may be subjected, except when thereby brought into a condition more favourable for the intended purpose, and which will hold the particles of the bone-dust apart and prevent their forming, either by themselves or with the dividing agent, a paste that is comparatively impervious to the solution or liquid it is desired to filter.

1084.—James Walker, engineer, and John Wharrie, foreman iron-founder, both of Glasgow, in the co. of Lanark, N.B., for "*Improvements in apparatus for the manufacture of cast-iron pipes and similar articles.*" Patent dated March 29, 1868.

This invention relates to the manufacture of cast-iron pipes and similar articles, and it comprises arrangements admitting of dry sand being used as the coating material for the cores, instead of the comparatively expensive loam and haybands generally employed. The invention also comprises improved apparatus for shaping the surfaces of the mould and core at the faucet when the pipe is to be cast with the faucet downwards. The main features of the invention consist in the coating of cores with sand for the manufacture of cast-iron pipes and similar articles by means of a revolving hopper with screw or inclined blades, and in the shaping of the inverted faucet parts of the moulds and cores by means of appliances substantially as described.

1090.—Miles Hawthornthwaite, of Lancaster, clerk, and Thomas Abbott, of Lancaster, plumber, both of the co. of Lancaster, for "*Improvements in taps, cocks, valves, &c., for water, gas, steam, or other liquids.*" Patent dated March 31, 1868.

The essential feature of this invention is the application of two circular discs or facings of metal, leather, wood, steatite, ebonite, vulcanite, glass, bone, ivory, porcelain, earthenware, soapstone, gutta-percha, or other suitable material having a corresponding curved slot-hole in each for the water-way. One of the facings is fixed or stationary, having a round hole in the centre; the other or moveable facing has a square socket or hole in the centre to receive a spindle squared at the end, which passes through a gland or stuffing-box in the shell or body of the tap and through the round hole in the stationary or fixed facing. The discs or facings can be made of any of the above materials, but by preference (for cold water) a fixed facing of metal and a moveable facing of leather fixed in a backing or casing of metal, or a fixed facing of leather backed by a disc of metal, and a moveable facing of metal (for hot water or steam), two metal facings, or one of metal and one of wood, porcelain, or other material. The body or shell of the tap is made in two parts (of any convenient form, according to the purpose for which it is intended), joined together by male and female coupling-screws, or by flanges and screws, and a leather or other suitable washer. In the outlet half of the shell or body of the tap, to which is attached the nozzle and gland, a recess is formed in the flange, to receive the fixed facing, which has a flange which is let in flush with the flange of the shell or body of the tap. The inlet half of the tap is formed to allow the moveable face to work freely in it. The moveable facing is merely slipped on the end of the spindle, the pressure keeping the facings together, which (each having a true or level surface) prevents the leakage or escape of water until the two curved slot-holes are brought opposite each other by turning the spindle. Where the pressure is very low, or for hot-water range cocks, a screw or spring is introduced, or a pivot is formed on the lower part of the disc and the body of the tap, to keep the surfaces in contact. The advantages of these facings are that, having true and level surfaces, and working with a circular or rotary motion, every such motion has a tendency to improve rather than deteriorate their surfaces; also, the facings never moving off each other, prevents any corroding action the water might have upon them. Thus it will be seen that the objectionable screw-spindle is done away with, the wear and tear is almost nil, and the construction and working of the tap much simplified; also that the facings will of a necessity wear several years longer than any at present in use, by simply having only the pressure of the water against them. If it should be found necessary at any time to renew one or both of the facings, it can be done at a trifling cost, leaving the body or shell of the tap intact.

The improvements herein specified are applicable to ordinary bib-cocks, ball or cistern cocks, lever or self-closing cocks, hot-water or range cocks, and to steam and other cocks or valves.

1094.—John Henry Weston, of Kennington Road, in the co. of Surrey, gas engineer, for "*Improvements in the means or apparatus for lighting and ventilating the interior of buildings, combining a decorative effect.*" Provisional protection only obtained. Dated March 31, 1868.

In carrying out this invention openings are made in the ceiling of the building or area to be lighted, of suitable diameter, in which a cone or cones are introduced, formed of lattice-work, or otherwise perforated and ornamented to suit the design of the ceiling, by which means the opening is in a great measure concealed from view, and at the same time serves as an outlet for the heated air which passes out through the perforations in the cone, and is conveyed away in a suitable manner. From this cone is suspended a gaselier, at one or more points, consisting of a pendent tube, at the lower end of which is arranged a number of horizontal gas-tubes, the lines of which form a floral or other design, by preference around an oval or other shaped ring or centre, the whole being suspended at such a distance from the ceiling as will give a minimum of shadow, according to the nature of the ornaments thereon, the purpose being to illuminate the ceiling as much as possible. At the salient points of the gaselier, which, as above described, are formed of horizontal tubes, are also placed horizontal burners, preferably of spray form, for the purpose of illuminating the apartment, and a series of perforations are made along the sides of the tubes, forming horizontal gas-jets, which serve to display the design of the gaselier when lighted.

1098.—Henry Harrison Doty, of 15, Bury Street, S.W., in the co. of Middlesex, gentleman, and George Graveley, of 29, Alfred Street, Bow, in the co. of Middlesex, engineer, for "*Improvements in the means or apparatus for producing the more complete combustion of gas, paraffin, and other liquid hydrocarbons.*" Patent dated April 1, 1868.

This invention relates to a lamp for producing the more complete combustion of gas, paraffin, and other hydrocarbon oils, and consists chiefly in applying flanges projecting both towards the centre and periphery of the lamp at a convenient point above the flame in such manner that a current of air is injected into the said flame, thereby obtaining a most brilliant light, and ensuring the more complete combustion of the carbon. A series of tubes or cylinders of different diameters, corresponding with the number of burners, are arranged vertically one within the other, and uniformly brazed or soldered at the lower end to a plate or disc in such manner as to leave alternate air and cotton or wick spaces, the said air spaces being continued through the plate or disc, and having a second series of moveable tubes or cylinders passing through them, on the top of which are placed the flanged rings for projecting the air into the flame, the said cylinders and flanges being raised and lowered by a rack and pinion, or any other well-known means. The said cylinders have ribs either on the outside or inside or both for dividing the air spaces into equal parts. The interior cylinders and flanged rings may be dispensed with when required, and a tube passed up through the central air space, the top forming a socket for a flanged stem of any required size, which guides the air to the flame in the same manner as the above-mentioned flanged rings, and which may be raised and lowered in the tube by a rack and pinion, as before described. A bracket for carrying the chimney, also raised and lowered by rack and pinion, encircles and may be fastened to the outer cylinder, so that both

the bracket and cylinder may be raised and lowered together if required, the said bracket having perforations for the admission of air to the outside of the flame.

1128.—CYRUS W. BALDWIN, of Boston, in the co. of Suffolk and state of Massachusetts, U.S.A., for "*A new and useful device or instrument for measuring and registering the amount of a flowing liquid.*" Patent dated April 3, 1868.

One object of this invention is to produce an instrument or a device for measuring and indicating the contents of a flowing liquid under any conditions of such flow of liquid, whether escaping in a large body, and under great or little pressure, or escaping drop by drop. Another object of the invention is to construct the apparatus in such manner as to require no nice fitting or grinding or high finishing of parts, and with no possibility of clandestine escape of liquid from it by leakage, the apparatus under these conditions of things being simple and cheap of construction.

The invention consists in a hollow circular case or box of suitable construction, divided at its centre into two separate chambers by an elastic diaphragm, each of such chambers being constructed with an inlet and outlet aperture or passage, the two outlets joining in one general outlet, and the inlet in like manner communicating with one general inlet or supply throat, and provided with valves connected with the diaphragm for allowing the liquid to alternately escape from one chamber, and closing the escape from the opposite chamber.

1131.—JEROME VALENTINE JONES and GEORGE JAMES WILLIAMS, both of Birmingham, in the co. of Warwick, manufacturers, for "*Improvements in the manufacture of ornamental metallic tubes.*" Patent dated April 3, 1868.

This invention consists in taking a plain strip of sheet brass or other sheet metal, and indenting or impressing upon the said strip the required ornamental pattern or design by means of rolls, and finally bending the ornamented strip into an open-jointed tube in the ordinary manner; also making the said tubes by taking a compound strip, ornamenting the said compound strip by rolls, and finally bending it into an open-jointed tube in the ordinary manner.

1151.—EUGENE HAY, of 83, Lombard Street, in the City of London, for "*Improvements in means or apparatus for measuring and indicating the passage or flow of liquids.*" A communication. Provisional protection only obtained. Dated April 6, 1868.

According to this invention the liquid to be measured is caused to flow through an annular chamber, which thereby becomes filled. In this annular chamber there is a series of buckets, floats, or paddles, supported so as to move therein from an axis capable of revolving. These buckets, floats, or paddles, by the action of the liquid passing through this chamber, have motion given to them to move the axis to which they are affixed. The inner surface of the annular chamber is formed with teeth or serrations, which control the action of the liquid on buckets or hollow floats. As the buckets, floats, or paddles revolve and give motion to the axis to which they are applied, motion is given from such axis to a chain or series of wheelwork with dials to indicate the extent of liquid passed. The passage or flow of the liquid is regulated by a cock or tap, or cocks or taps.

1152.—JAMES DUNBAR, of 49, Vicarage Road, Camberwell, S.E., engineer, and RICHARD NICHOLSON, of Dulwich, S.E., gentleman, all in the co. of Surrey, for "*Improvements in machinery for inserting and depositing coal, cannel, or other substances into gas-retorts or other ovens, and for withdrawing the same after distillation; also for retort mouthpieces, chambers, doors, and covers or lids.*" Patent dated April 6, 1868.

This invention relates, firstly, to certain peculiar constructions, arrangements, and combinations of machinery or apparatus for feeding or introducing coal or other like substances into gas-retorts or ovens, and for withdrawing or removing the same after distillation. Secondly, to certain peculiar constructions and arrangements of the doors and door-fittings of gas-retorts, whereby existing retorts are rendered better adapted for being supplied with coal or other gas-producing material by combined feeding and withdrawing apparatus. Thirdly, to a peculiar arrangement of the mouths of gas-retorts, whereby any one or more of a bench or group of retorts may be opened for cleaning or repairs without stopping the working of the rest or causing loss or waste of gas therefrom.

The combined apparatus consists of two parallel overhead rails, supported on columns which extend longitudinally along the retort-house, and parallel to the range of retort-mouths. These rails support a traveller, which is provided with running wheels running along the longitudinal rails. Other running wheels, mounted on a carriage or cradle, run transversely to the rails along the traveller. It will thus be seen that the cradle may be moved horizontally towards or from the mouths of the retorts, and may be brought opposite to any retort in the series. The traveller carries a grooved pulley or chain-wheel, over which an endless rope or chain is passed for the purpose of rotating the same. On the spindle of this chain-wheel or pulley there is keyed a spur-pinion, which gears with a spur-wheel fast on the axis of one of the running wheels of the traveller, thereby imparting motion thereto. The movement of the cradle along the rails of the traveller is effected by means of a winch handle. On rotating this handle motion is imparted to an endless chain or band, which passes round the before-named pulley on the axis of the handle, and over a larger pulley on the axle of one of the running wheels of the cradle, and consequently transmits a travelling motion thereto in either direction along the rails of the traveller. From the cradle or carriage are suspended wrought-iron frames, which support a combined scoop and rake.

The outer end of the scoop, or that which is farthest from the retorts, is made cylindrical, and this cylindrical portion forms the journal for the rotation of the scoop on its longitudinal axis. There are radial lever-arms, provided with bearings at their lower ends, for embracing and supporting the cylindrical portion of the scoop. These arms are keyed on to a rocking-shaft carried in bearings in the lower end of the suspended frames. The said rocking-shaft carries a worm-wheel, into which gears a worm on the worm-shaft actuated by a hand-wheel. The attendant in charge of the machine stands on the travelling platform, and by manœuvring the endless chain, or the winch handle, or the hand-wheel, as may be required, produces all the movements requisite for introducing and withdrawing the scoop into and from the retort, and transporting it either in a horizontal or a vertical direction from one retort to another. On rotating the endless screw or worm the rocking-shaft rotates partially, by which means the radial lever-arms will be brought to different positions, thus raising the scoop to the height of any one of the retorts in the "bench."

In order to maintain the upper surface of the scoop perfectly horizontal during this movement, we propose to employ any simple form of parallel motion; it is found that the desired result may be readily obtained by the aid of an endless chain passing over two equal-sized chain pulleys, one being stationary and keyed or secured to a bearing, and the other fitted loosely upon the cylindrical part of the "scoop," but coupled therewith by the intervention of the well-known arrangement of detent and ratchet wheel. The object of the detent and ratchet arrangement is to enable the scoop to be reversed or turned over in its bearings, for the purpose of discharging the coal into the retort (without interference from the chain-wheel) after it has been introduced into such retort; whilst the detent serves to couple the chain-wheel with the scoop when imparting the necessary parallel motion to the scoop, for keeping its open side upwards or horizontal.

With the feeding-scoop is, in most cases, combined one or more moveable blades or series of moveable blades, rakes, or hoes. These hoes are intended to answer the purpose of the discharging-rakes or appliances heretofore employed for withdrawing the charges from gas-retorts, and by combining such hoes with the feeding-scoop the two operations of feeding the retorts and withdrawing the charge may be performed by the one combined apparatus, which operations have heretofore always been performed by the aid of separate and distinct instruments or appliances. Two or more of these hoes are keyed on to two parallel rocking-shafts disposed longitudinally in bearings fitted inside the scoop, or, if preferred, one rocking-shaft and series of hoes may be combined with the scoop. In the former arrangement the hoes may be rather smaller than in the latter case. These hoes may be of various forms according to the shape of the retort, and when not in action they lie transversely across, the scoop being enclosed within the hollow or trough thereof. Before feeding the retort it is necessary to withdraw the coke or residual products of the destructive distillation, for which purpose the combined scoop is introduced in an inverted position into the retort, the hoes being well within the hollow of the scoop, so as to pass freely over the surface of the coke until the scoop has entered a sufficient distance therein. In this position the rocking-shaft or the pair of rocking-shafts, as the case may be, are partially rotated in their bearings by the action of the hand-wheel and gearing fast on the outer ends of the rocking-shafts, when two are used, thereby causing each hoe to describe an arc of a circle in a downward direction, so as to cut transversely across the mass of caked fuel or coke in the retort from side to side thereof at each point where a hoe or pair of hoes occur. In this condition the scoop is withdrawn from the retort by running back the cradle, and the entire contents of the retort will be drawn out with it at one single stroke or traverse, leaving the retort ready for a fresh charge. The hand-wheel is now turned in the reverse direction, which has the effect of turning the blades or hoes inside the scoop again, and by continuing to act upon the same hand-wheel the rotation of the scoop in its bearings will be accomplished. If desired, bevel-wheel or other suitable gearing may be employed for turning the scoop; but in single-scoop machines it is found convenient to apply hand power direct. The patentees do not confine themselves to any particular mode of reversing the scoop.

When using steam power for driving or actuating the aforesaid apparatus, it is preferred to mount the engine upon the same carriage or cradle that supports the scoop or scoops, and to supply the steam from a stationary boiler through a flexible steam-pipe.

In order that the retorts may be charged and discharged with facility by means of the aforesaid apparatus, it is found expedient to provide them with hinged doors or covers in substitution for the ordinary loose covers, each retort-mouth having its own door. For this purpose it is proposed to apply to existing retorts, whether of the circular or D section, a cast-iron frame. This frame may be secured by bolts or otherwise to the ordinary retort-mouth, and carries a hinge to which the door is hung. On the inner face of the door there is provided a projecting rim, which fits into a corresponding groove in the frame, such groove being filled with any good lute before the door is closed. By this means a perfectly gas-tight joint is readily obtained. The door is tightened up by a central screw in the swivel cross-bar, which fits into lugs at the top and bottom of the frame.

1172.—CHARLES WILLIAM SIEMENS, of 3, Great George Street, Westminster, in the co. of Middlesex, for "*Improvements in the application of gas-furnaces to evaporating, smelting, puddling, and other manufacturing purposes.*" Patent dated April 7, 1868.

This invention refers to a previous patent, dated Jan. 22, 1861 (No. 167). According to this invention, instead of constructing the regenerators in a vertical position and closely, side by side, as was generally done heretofore, extending to a considerable depth below the furnace, the patentee arranges them horizontally beneath the furnace, extending, in some cases, partially beyond the same, the two generators of each pair being placed one above the other, by preference the gas-regenerator uppermost, and the two pairs being so arranged by preference with passages between them, or at the sides or ends thereof, as to be accessible for clearing them of deposits when required. The walls of the regenerators are, for this purpose, in some cases, provided with closed side apertures for the introduction of clearing tools, or, in other cases, the regenerators are so arranged as to be readily cleaned or refilled from the top. Closed apertures are also provided in the roof of the furnace, over the vertical passages leading from the regenerators into the furnace, in order to gain access to these for clearing them of deposits. This horizontal arrangement of regenerators has the further advantage of requiring comparatively little depth below the ground-line of the furnace, whereby the construction thereof is facilitated.

1195.—ALFRED HENRY STILL, of Rockboro' House, Cork, and DENNY LANE, of 72, South Mall, Cork, for "*Improvements in the manufacture of gas.*" Patent dated April 9, 1868.

This invention has for its object improvements in the manufacture of gas. For this purpose small coal is mixed with gas tar, and the mixture is moulded into bricks or blocks; these bricks or blocks are charged into gas-making retorts, which are heated to a bright heat, and so an illuminating gas of good quality is obtained, whilst at the same time the bricks or blocks are converted into a hard and valuable coke. The tar and small coal may advantageously be mixed in the proportion of, say, 30 gallons of tar to one ton of small coal. Also breeze or small coke and peat mould may be used in preparing the bricks or blocks. In some cases the gas tar is distilled before being used to make the bricks or blocks; the naphtha and the pitch are thus separated for sale, and to make the bricks or blocks only the intermediate product called dead oil or creosote is used, which is of small commercial value. The apparatus employed for moulding the mixed materials may be such as is used for moulding similar materials for use as artificial fuel. The blocks may conveniently be of the size of ordinary bricks or larger, and the pressure applied in moulding should be sufficient to make a firm block. The manufacture of gas from such blocks is conducted as when coal is employed for gas-making.

The claim is for the manufacture of gas from moulded blocks of small coal or coke, or breeze, or peat mould and tar, or dead oil or creosote, by the distillation of such blocks in retorts, as above described.

1201.—ROBERT ALFRED WRIGHT, of Homerton, in the co. of Middlesex engineer, for "*Improvements in heating structures and articles, and in the mode of and apparatus for obtaining heat from petroleum and other hydrocarbons, and in apparatus for supplying air to furnaces.*" Patent dated April 9, 1868.

Instead of using water for heating houses, carriages, baths, and drying-stoves, and for other heating purposes, a solution of glycerine is employed, which may be more or less concentrated, if desired, and which is employed in ordinary circulation-pipes, coiled where required. One mode of heating the glycerine, which mode may also be employed for obtaining, maintaining, and increasing heat in furnaces for other purposes, consists in blowing or projecting one or more currents or jets of steam or air (superheated or otherwise) across or over the mouth of a pipe or chamber, containing petroleum or other hydrocarbon, which petroleum or hydrocarbon is thereby projected in minute particles or sprays, into the furnace, on to fuel, clinkers, or other substances, on the grate-bars or hearth. At the same time, air is drawn or forced into the furnace. Great heat is thus obtained.

1211.—HENRI ADOLPHE ARCHEREAU, of 29, Boulevart St. Martin, Paris, France, chemist, for "*A new method of obtaining heat and light, and its various applications.*" Provisional protection only obtained. Dated April 11, 1868.

This invention relates to a new mode of producing and applying light and heat from gases obtained by the mixture of inflammable gases and atmospheric air, or other agents used to assist combustion, supplied under pressure in various liquids or liquefiable pulverized or viscous matters. The invention is somewhat similar to some processes already in use, but differs entirely from them in many respects, and more especially in the manner of applying the jets, which are thus rendered utilizable for various purposes under high pressures. The inflammable and other gases are compressed, and constantly, if necessary, to a great number of atmospheres, either in one or more receivers, care being taken to maintain, by means of pumps or other apparatus working continuously, an equal, regular, and sufficient pressure in the cylinders or receivers, to produce in the pipe or combustion apparatus a very rapid and constant flow of the explosive mixed gases, which mixture, when separate receivers are employed for the air and inflammable gases, is produced by introducing them simultaneously into tubes of sinuous form, where they are mixed before passing to the burners for consumption in regulated proportions; so that all the inflammable gas will be burnt, but without any excess or deficiency of atmospheric air or other carburetting agent for producing combustion, especially when the flame is required to be of the highest possible temperature.

1215.—ERNEST DUBOIS and EDWARD CASPER, both of 101, Cannon Street, in the City of London, merchants, for "*Improvements in wet gas-meters.*" A communication. Patent dated April 11, 1868.

This invention relates to gas-meters in which the water is supplied from a reservoir or fountain to the measuring drum or cylinder in such a manner as to maintain the proper water level in the same.

The nature of the invention consists in the peculiar arrangement of the inlet-tube and valve chamber; in the novel arrangement of the valve-float and syphon, whereby the gas is admitted from the said valve-chamber to the measuring drum or cylinder; and in the peculiar construction and arrangement of a regulating device, whereby a proper water level is maintained in the said drum, and whereby the height of such water level may be varied or adjusted to make the measuring capacity of the meter accord accurately with the index. The inlet-tube is placed upon the front compartment of the case which forms the reservoir or fountain, and in such a position that no fraudulent communication can be effected through the said tube with the measuring-drum. The valve-chamber is divided into two compartments, one above the other. The plate or partition which separates these two compartments carries the seat of the valve, whereby the gas is admitted to the lower compartment. The valve is fixed on the upper end of the rod or spindle of the float, which is entirely submerged in the water in the reservoir. The said float is constructed with its upper part spherical and its lower part conical, and its centre of gravity is thereby so placed as to ensure the float keeping naturally a vertical position without the aid of guides or supports which produce friction, while the tube in which the rod of the float is enclosed is made of such a diameter as not to interfere with the free movement of the said float. To the bottom of the lower compartment of the valve-chamber is attached the syphon or pipe which conducts the gas from the valve-chamber to the measuring-drum. The syphon or pipe is soldered to the lower compartment of the said valve-chamber, and passes through the partition dividing the reservoir from the said drum.

The improved regulating device for maintaining the proper water level in the measuring-drum is constructed to be readily adjustable vertically, and is kept perfectly air or gas tight at all the joints or connexions of the tubes or pipes without the use of stuffing-boxes. A box or chamber is connected with tubes, which communicate with the upper part of the fountain or reservoir, with either the measuring-drum or with the syphon or other portion of the inlet-passage and with the waste-water chamber. The first of these tubes extends vertically from the top of the regulating-chamber, and is provided with an aperture at its upper end communicating with the upper part of the reservoir, while its lower end extends inside the said chamber. A hole or orifice is made in the side of the said tube just above its lower end. On the upper part of this tube is a regulating screw, which extends through the top of the meter, and is provided with a head to receive a key or other device whereby the said screw may be turned to raise or lower the tube and chamber. Another tube extends from the bottom of the regulating-chamber to the measuring-drum, and forms a communication between the two vessels, so that the water-level is the same in both. The waste-pipe extends from the side of the regulating-chamber to the waste-water chamber, and is preferably provided with a funnel or trough over which the water flows when it rises above its proper level in the drum. The orifice in the side of the vertical pipe and the funnel of the waste-pipe determine the height of the water level, which cannot remain below the first or above the second. The other tube is preferably arranged to connect the top of the regulating-chamber with the syphon-pipe or other portion of the inlet-passage. All of these pipes or tubes are made of lead, and are curved or bent in such a manner as to be flexible, and yield readily when the chamber is adjusted by its regulating-screw.

1250.—JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the co. of Middlesex, gentleman, for "*Improvements in heating and ventilating, and in apparatus employed therein.*" A communication. Patent dated April 16, 1868.

This invention has for its object the radiation, diffusion, and distribution of heat, either in the same apartment in which the warming apparatus is situate and heated, or in places remote from where the fire is applied to the said apparatus, and consists in the use of a small proportion of liquid or vaporizable material enclosed within an air-tight cylinder, vessel, or pipe, having a large steam space as compared with the volume of the liquid; the radiating and condensing surfaces of the apparatus being so placed that all the water of condensation shall flow back again to the generator, or that particular part where the heat is applied, to be again converted into steam or vapour, which fills the entire capacity of the apparatus, and consequently diffuses its heat thereto. It is also proposed to cause steam to circulate through endless pipes or coils, having no openings, such pipes or coils containing only a very small quantity of liquid in proportion to the capacity of the pipe in a coil or bend of the pipe. One branch of this pipe must be so placed or inclined as to ensure the free return of the water of condensation to that part of the coil or generator to which the heat is directly applied. The proportion of liquid to the cubical contents of the radiating and condensing vessel or pipe which has been found to answer well in practice is about two cubic inches of liquid to one cubic foot of space in the steam chamber or pipe. This system of heating is applicable to culinary purposes as well as to warming and ventilating apartments.

1279.—JOHN COOKE, of Darlington, in the co. of Durham, mining engineer, for "*Improvements in the construction of rotary engines and pumps.*" Patent dated April 20, 1868.

This invention consists of a novel construction and arrangement of such rotary pumps and engines as have a cylindrical piston rotating eccentrically in a cylinder, and which have also a shutter constantly kept close or near to the same, and passing in and out through a suitable port in the circumference of the cylinder of the same length as the piston in such a manner as to divide the inlet from the outlet of the rotary pump or engine. The invention is especially applicable to blowing and exhausting machines and to pumps and water-engines, but is also adapted to engines in which the motive power is derived from an elastic fluid.

By this invention the objection to the shutter as heretofore constructed is removed, by making it describe an arc of a circle, which avoids the slot in the shutter-box, the axis of such arc being a bar parallel to the cylinder and passing through a stuffing-box at the end of the shutter-box, the same being so placed as to form a sufficient guide and support for the shutter, and so actuated from without the shutter-box by a lever as to form the means of reciprocating the same, and also so placed as to secure a favourable angle of the shutter with the piston. The lever which actuates the axis bar is made of the same length as the radius of the arc which is described by the shutter at its line of contact perfect or approximate with the piston, and is so placed, by preference, as to have one end fitting the axis bar, while the other end at its centre coincides with the said line produced. To this other end is attached the connecting-rod, the length of which is equal to the radius of the piston, and is actuated by a crank or eccentric, the centre of which is the centre line of the piston. By this construction an equable motion of the shutter with the piston at their said line of contact is produced independently of any pressure of the one upon the other.

1283.—WILLIAM MALAM, of Old Kent Road, in the co. of Surrey, gas engineer, for "*Improvements in the manufacture of gas and in apparatus employed in such manufacture, part of the invention being also applicable to the manufacture of retorts, retort-casings, crucibles, and melting-pots for various useful purposes.*" Provisional protection only obtained. Dated April 20, 1868.

Hitherto dead oils of naphtha and coal tar have not been used for illuminating purposes, whereas according to this invention such dead oils are employed, being fed into heated retorts in order to manufacture gas therefrom, and such oils are kept in a sufficiently warm and fluid state by means of heated air conveyed to the reservoir containing them by a tube or duct leading to near the bottom of the oil-reservoir from the furnace or retort-chamber.

The improved apparatus for the manufacture of gas from oil is thus constructed:—The furnace or chamber containing the retorts is constructed with flues leading upwards from the fireplace, and passing between and beside the retorts, and they are fed with fuel as required through feeding-holes at their upper ends, such fuel dropping through them to the fire. The oil is fed into the retorts from a reservoir mounted above the furnace, whence the oil descends through short pipes provided with stop-cocks into feeding and regulating gauges communicating with the retorts. The gas is carried upward from the retorts through discharge-pipes into a valve-box or indicating-chamber at the upper part of the apparatus, the said pipes entering therein and descending to nearly the bottom thereof, so that the cessation of sound in any of the pipes will indicate the cessation of work in the retort with which the same may correspond.

Next the invention has for its object an improved manufacture of gas and other retorts, retort-casings, crucibles, and melting-pots. These articles are manufactured, according to this invention, of a composition consisting of asbestos or talc (or compounds thereof), combined with fire-clay, fire-brick, rough stuff, or other refractory material. One mode of manufacturing the articles is the following:—After mixing the refractory material with water, and kneading it so as to obtain it in a pasty consistency on the mould, the asbestos or talc is worked into the material, being laid on in films, flakes, or layers, or in a powdered or pulverulent condition, so that it becomes incorporated with the material.

1303.—JOHN JOHNSON, of Levenshulme, near the city of Manchester, millwright and engineer, for "*Improvements in metallic packings for pistons, pump-buckets, and valves.*" Provisional protection only obtained. Dated April 22, 1868.

This invention consists in making metallic packings of two eccentric conical expansion rings, which, when cut across at the thinnest part, and placed together on the body of the piston or pump-bucket, fit one within the other, and the thicker portion of one ring comes opposite the thinner portion of the other. A pin is let in to the outer ring to keep the rings in their proper relative positions. The packing-rings are held by the lid of the piston or pump-bucket. The thin part of the thinnest portion of the rings is made quite sharp or knife-edged, and the thin part of the thicker portion of the rings is flattened; the conical shape of the outside of the inner ring and of the inside of the outer ring produce a lateral pressure on the flange of the piston-block and on the lid, and which pressure ensures a steam, water, or air-tight joint.

1317.—HENRY HILL, of the town and co. of the town of Nottingham, brass-founder and general manufacturer, for "*Improvements in water-closets and in ball and other cock, taps, and valves.*" Patent dated April 22, 1868.

These improvements in water-closets consist in the employment of a vertical cylinder which has a flange at or near its lower end, by which it is secured to an S-shaped, D-shaped, or otherwise shaped trap of the usual construction. Above the flange, but inside of the cylinder, is a seat, which is turned out to receive a plunger open at its lower end. The depth of the

plunger is somewhat greater than the diameter of the orifice of a short pipe which projects from the side of the cylinder, and has at its outer end a flange by which the cylinder is connected with the lower part of the basin. The bottom of the plunger is turned by preference slightly conical; the conical part, when the plunger is lowered, will fit tightly into an india-rubber or other ring securely held between the flanges of the cylinder and the S-shaped or otherwise shaped trap, thus forming a seat for the plunger to fall into. On the upper end of the cylinder a hollow mould is cast, or otherwise formed. This mould passes entirely round the cylinder, and forms an inlet-pipe on one side of the cylinder, and an outlet-pipe on the opposite side thereof. Either or both of these pipes may be flanged, or otherwise formed to allow of a ready connexion with a supply-pipe, which may proceed from a water-supply cistern; the water from the outlet-pipe passes into the basin for flushing the same. The plunger is provided on its upper side with a strong rod, which passes through a stuffing-box or a tube at its upper end, and it is provided with a handle above the stuffing-box or tube through which it passes; this handle may stand above the seat of the closet, or it may fall into a recess in the seat.

These improvements in ball and other cocks and taps relate, firstly, to a ball-cock. The cylinder of this cock has a projection at the side, through which the liquid is supplied. Below this projection the cylinder is turned out to form a conical or otherwise shaped seat, which receives the lower end of a plunger passed through a hole in a plug screwed into the top of the cylinder. Below the screwed part is a pipe of india-rubber or other material, drawn over both plug and plunger. The plunger is sometimes bored out at the lower end, to receive a piece of leather or india-rubber, or its equivalent, to press upon the seat, thus forming a water-tight joint or stuffing-box. The upper part of the plug is split to receive the end of the ball-lever, in which it is held by a pin; the end of the lever also passes into a slot in the upper end of the plunger, so that as the ball falls the plunger is raised to allow the liquid to escape.

These ball-cocks are sometimes modified by the use of a tube or cylinder having studs at one end, to which studs a peculiarly shaped lever is hinged; part of this lever is somewhat enlarged. This enlarged part is covered by preference with india-rubber, and it falls into a seat turned out near to the studs; the other end of the lever, passing through the hole so formed, is acted upon by a two-armed cam upon a spindle which passes through the body of the tube or cylinder at right angles to the studs and lever.

1334.—CHARLES BROWN HARDICK and JOHN HARDICK, of Brooklyn, in the state of New York, U.S.A., for "*Improvements in direct-acting engines and pumps.*" Patent dated April 23, 1868.

The invention consists, first, in the employment of a valve-chest and prismatic or cylindrical valves, with openings at the ends of the valve-seats covered by a removeable cap to give easy access to the valves and seats. Second, in the use of a stationery piston in combination with a cylinder formed with or attached to a valve. Third, in the use of certain discs and recesses at the end of the cylinder above referred to, in combination with the valve above referred to, to cushion the valve and prevent concussion; and fourth, in the use of the ports in the valve-seat arranged as shown in combination with the steam-valve and auxiliary valve, as and for the purposes specified.

APPLICATIONS FOR LETTERS PATENT.

154.—NICHOLAS VOICE, of Handcross, in the co. of Sussex, plumber, for "*Improvements in apparatus connected with closets and urinals.*" Jan. 18, 1869.

162.—GEORGE BROWN, residing at 7, Beaumont Place, Edinburgh, in the co. of Mid Lothian, N.B., gas-meter index maker, for "*Improvements in gas-meters and other measures by apparatus for registering the passage of gas and other bodies.*" Jan. 18, 1869.

183.—EDWARD BARCROFT, of Rawtenstall, in the co. of Lancaster, plumber and glazier, for "*Improvements in the construction of cocks, taps, or valves for controlling the flow of water or other liquids.*" Jan. 20, 1869.

186.—HENRI ADRIEN BONNEVILLE, of 10, Sackville Street, Piccadilly, in the co. of Middlesex, and 18, Chaussée d'Antin, Paris, in the empire of of France, patent agent, for "*Improvements in the manufacture of illuminating gas and of sponge, by the action of hydrocarbon liquids or fluids on metallic ores, and in the furnaces for melting said sponge and other metals.*" A communication. Jan. 20, 1869.

188.—FREDERICK LIPSCOMBE, of 233, Strand, in the co. of Middlesex, water-filter manufacturer, for "*Improvements in purifying and storing water, and in the apparatus employed therein.*" Jan. 20, 1869.

227.—CLINTON EDGCUMBE BROOMAN, of the firm of Robertson, Brooman, and Co., of 166, Fleet Street, in the City of London, patent agents, for "*Improvements in the construction of cocks or valves.*" A communication. Jan. 25, 1869.

243.—WILLIAM ROBERT LAKE, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*Improvements in ventilating apparatus.*" A communication. Jan. 26, 1869.

245.—HENRY LAW, of Essex Street, Strand, in the co. of Middlesex, civil engineer, for "*Improvements in apparatus for connecting soft metal and other pipes, and for attaching cocks and other fittings thereto.*" Jan. 26, 1869.

248.—COLIN MATHER, of Salford, in the co. of Lancaster, engineer, for "*Improvements in machinery or apparatus for singeing fabrics by gas flames.*" Jan. 27, 1869.

GRANTS OF PROVISIONAL PROTECTION.

19.—WILLIAM ADOLPHUS BIDDELL, of Edward Street, Parade, Birmingham, brassfounder and electro-plater, and JOHN REDGRAVE, of Pershore Road, Birmingham, gentleman, for "*Improvements in the manufacture and ornamentations of chandeliers, lamps, lustres, and other articles.*" Jan. 4, 1869.

29.—JOSEPH JUDGE HAYS, of King's Cross, in the co. of Middlesex, for "*Improvements in machinery or apparatus for obtaining and drying peat and carbonizing the same.*" Jan. 5, 1869.

45.—GEORGE EVELEIGH, of Tredegar Road, Bow, in the co. of Middlesex, consulting chemist, for "*Improvements in the manufacture and purification of gas for lighting, and in the means of applying the same to heating purposes, parts of which improvements are also applicable to the purification of mineral oil.*" Jan. 7, 1869.

46.—JAMES MANSERGH, of 3, Westminster Chambers, in the city of Westminster, engineer, for "*Improvements in stench-traps.*" Jan. 7, 1869.

72.—THOMAS MOORE, of 32, Bridge Street, Southwark, engineer, for "*Improvements in rotary engines, which may be used as pumps or water-meters.*" Jan. 9, 1869.

90.—BRISTOW HUNT, of 1, Serle Street, Lincoln's Inn, in the co. of Middlesex, gentleman, for "*Improvements in water-meters.*" A communication. Jan. 12, 1869.

95.—GEORGE VERRELL OSBORNE and ALFRED JAMES PEERLESS, both of Rahere Street, Goswell Road, in the co. of Middlesex, for "*An improved ball-valve or cock.*" Jan. 12, 1869.

100.—JAMES STEEL, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in sanitary arrangements to be substituted for water-closets.*" Jan, 13, 1869.

102.—JAMES PARKER, of 6, Lilford Road, Camberwell, in the co. of Surrey, gentleman, for "*Further improvements in motive-power apparatus applicable for propelling vessels, and for preventing vessels from foundering, and for forcing water, and for other purposes.*" Jan. 13, 1869.

104.—JULIUS SCHLÖSSER, of the city of Frankfort, in Germany, but at present residing at 14, Finsbury Place, in the co. of Middlesex, civil engineer, for "*A new or improved self-acting metallic packing for parts of steam, air, gas, water, or other fluid pressure engines, or for pumps or other machinery or apparatus in which packing is required.*" Jan. 13, 1869.

105.—WILLIAM ROBERT LAKE, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*An improved method of and devices for uniting the ends of pipes or tubes.*" A communication. Jan. 13, 1869.

107.—GEORGE DOMINICUS KITTOE and PETER BROTHERHOOD, both of 56, Compton Street, Clerkenwell, in the co. of Middlesex, engineers and millwrights, for "*Improvements in valves.*" Jan. 14, 1869.

115.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*An improved stop-motion and regulator for steam-pumps.*" A communication. Jan. 14, 1869.

148.—FREDERICK BRADY, of Camberwell, in the co. of Surrey, for "*Improvements in the commercial manufacture of sulphate of ammonia.*" Jan. 16, 1869.

154.—NICHOLAS VOICE, of Handcross, in the co. of Sussex, plumber, for "*Improvements in apparatus connected with closets and urinals.*" Jan. 18, 1868.

162.—GEORGE BROWN, residing at 7, Beaumont Place, Edinburgh, in the co. of Mid Lothian, N.B., gas-meter index maker, for "*Improvements in gas-meters and other measures by apparatus for registering the passage of gas and other bodies.*" Jan. 18, 1869.

186.—HENRI ADRIEN BONNEVILLE, of 10, Sackville Street, Piccadilly, in the co. of Middlesex, and 18, Chaussée d'Antin, Paris, in the empire of France, patent agent, for "*Improvements in the manufacture of illuminating gas and of sponge, by the action of hydrocarbon liquids or fluids on metallic ores, and in the furnaces for melting said sponge and other metals.*" A communication. Jan. 20, 1869.

188.—FREDERICK LIPSCOMBE, of 233, Strand, in the co. of Middlesex, water-filter manufacturer, for "*Improvements in purifying and storing water, and in the apparatus employed therein.*" Jan. 20, 1869.

NOTICES TO PROCEED.

2813.—FREDERICK WARNER, of Jewin Crescent, in the City of London, engineer, for "*Improvements in constructing bore-holes or wells, and in pumps to be used therewith and for other purposes.*" Sept. 12, 1868.

2831.—MARTIN BENSON, of 14, Hinde Street, Manchester Square, in the co. of Middlesex, for "*Improvements in steam pumping machinery or engines.*" A communication. Sept. 15, 1868.

2832.—ENOCH SARJEANT, of Birmingham, in the co. of Warwick, metal-worker, for "*Improvements in the manufacture of gaseliers, gas-pendants, gas-brackets, gas-standards, and other gas-fittings.*" Sept. 15, 1868.

2863.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in apparatus for raising water and other fluids.*" A communication. Sept. 17, 1868.

2866.—HENRY WILSON, of Stockton-on-Tees, in the co. of Durham, for "*Improvements in engines worked by hydraulic fluid or steam power, and in mechanism or apparatus used in regulating the supply of water or other fluids, the same being applicable, amongst other uses, to water-closets, lavers, and gas-pipes, for the prevention of waste of water, gas, or other fluids.*" Sept. 17, 1868.

2881.—WILLIAM NEEDHAM and JAMES KITE, both of Vauxhall, in the co. of Surrey, engineers, for "*Improvements in machinery or apparatus for depurating fluids.*" Sept. 18, 1868.

2883.—WILLIAM HENRY HUGHAN, of Newton Stewart, N.B., postmaster and guano and seed merchant, for "*Improvements in the treatment of night-soil, sewage, and other like refuse matters, for the purpose of deodorizing and converting the same into manure.*" Sept. 19, 1868.

2902.—CHARLES WHEELER, of Speenhamland, in the co. of Berks, smith and ironmonger, for "*Improvements in apparatus, taps, or joints for turning on and cutting off the supply of liquids and fluids.*" Sept. 21, 1868.

2931.—CHARLES HENGST, of Fulham Road, in the parish of Chelsea, in the co. of Middlesex, engineer, HENRY WATSON, of the same place, gas-fitter, JOHN BELL MUSCHAMP, of 68, Upper Thames Street, in the City of London, paper manufacturer, and NEWTON WILSON, of 144, High Holborn, in the co. of Middlesex, sewing-machine manufacturer, for "*Improvements in the manufacture of carburetted hydrogen or luminous gas.*" Sept. 24, 1868.

3694.—MATTHEW PIERS WATT BOULTON, of Tew Park, in the co. of Oxford, gentleman, and JOHN IMRAY, of Westminster Bridge Road, in the co. of Surrey, engineer, for "*Improvements in rotary propellers, pumps, and fans.*" Dec. 4, 1868.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

93.—JOSEPH COOK ANGUS and GEORGE STUART, "*Improvements in apparatus for drawing off and measuring liquids.*" Jan. 11, 1866.

102.—WILLIAM JOHN WALSH, "*Improvements in cocks, taps, and valves.*" Jan. 12, 1866.

110.—JOHN CALVIN THOMPSON, for "*Improvements in means or apparatus employed in the combustion of gas in gas-stoves and burners employed in heating and cooking.*" Jan. 13, 1866.

175.—JAMES SHEKLETON and JOHN WILLIAM GIBSON, "*Improvements in pumping-engines for feeding and forcing fluids.*" Jan. 19, 1866.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

113.—WILLIAM CLELAND, "*Improvements in treating and utilizing certain materials used and products obtained in the manufacture of gas, and in apparatus connected with the said treatment.*" Jan. 15, 1862.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Price per Share.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	14 — 15
1000	20	Do., preference	20 0 0	10 0 0	23 — 24
750	20	Do., do., redeemable	20 0 0	10 0 0	21 — 22
40000	5	Bombay (Limited)	5 0 0	4 0 0	3¾ — 4
10000	5	Do., third issue	4 0 0	4 0 0	2¾ — 3
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge, & Holywell.)	20 0 0	10 0 0	29½ — 30½
12000	50	*Chartered*	50 0 0	7 0 0	57 — 58
6000	50	Do.	45 0 0	7 0 0	49 — 50
10000	20	*City of London*, A shares	20 0 0	9 0 0	26 — 26½
10000	10	Do., B shares	10 0 0	4 0 0	6 — 7
9629	10	Do., new shares	10 0 0	9 0 0	12 — 13
25000	25	City of Moscow (Limited)	25 0 0	nil.	2½ — 3½
17490	25	*Commercial*	25 0 0	10 0 0	35 — 36
20000	20	Continental Union	20 0 0	5 0 0	18 — 18½
5213	20	Do., preference	20 0 0	7 0 0	20 — 20½
5000	10	*Crystal Palace District*	10 0 0	10 0 0	14 — 15
5000	10	Do., preference	10 0 0	6 0 0	12½ — 13
10000	10	Do., new shares	2 10 0	7 0 0	2½ — 3
4000	50	*Equitable*	50 0 0	10 0 0	69 — 70
4000	25	Do., new shares	25 0 0	10 0 0	34½ — 35
23406	10	European (Limited)	10 0 0	11 0 0	15 — 15½
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	7½ — 7¾
20000	10	*Great Central Gas Consumers*	10 0 0	10 0 0	14½ — 15
5000	10	Hong Kong (Limited)	10 0 0	6 0 0	8 — 10
26000	50	*Imperial*	50 0 0	10 0 0	63½ — 64
26000	10	Do., new shares	3 0 0	10 0 0	4½ — 4¾
26000	12½	Do., new shares	3 0 0	7 0 0	3¼ — 3¾
1300	100	Do., bonds	£100	10 0 0	175 —180
28000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	16 0 0	98 — 99
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	56 — 58
3000	10	Do.	10 0 0	5 0 0	7 — 8
3000	20	Do.	15 0 0	7 10 0	15 — 16
7133	50	*London*	50 0 0	10 0 0	65½ — 67
5610	25	Do., 1st preference	25 0 0	6 0 0	26 — 28
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
		Nictharoy, Brazil (Limited)			
12000	5	Malta and Mediterranean (Limited)	5 0 0	5 0 0	3½ — 4
6000	5	Do., preference	5 0 0	7 0 0	— 5
30000	5	Oriental (Calcutta)	5 0 0	10 0 0	7 — 7¼
30000	5	Do., new shares	1 0 0	10 0 0	1 — 1¼
10000	5	Ottoman (Limited)	5 0 0	nil.	1 — 2½
12500	10	Pará (Limited)	10 0 0	7 10 0	8 — 9
27000	20	*Phœnix*	20 0 0	10 0 0	27 — 28½
3600	100	Do., new	35 0 0	7 10 0	37½ — 38
144000	8k.	Do.	100 0 0	5 0 0	75 — 77
5000	20	*Ratcliff*	20 0 0	10 0 0	24 — 25
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	24 — 25
6959	5	Singapore (Limited)	5 0 0	4 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
		Shanghai			
4800	50	*South Metropolitan*	50 0 0	10 0 0	73 — 75
4800	12½	Do., new shares	12 10 0	10 0 0	18 — 19
15000	10	*Surrey Consumers*	10 0 0	10 0 0	14 — 14½
10000	10	Do., new	6 0 0	10 0 0	8 — 8½
9000	4	United General (Limerick)	4 0 0	5 0 0	2 — 2¼
10000	10	*Victoria Docks*	5 0 0	6 0 0	
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
1500	10	Do.	10 0 0	7 10 0	
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	14½ — 15
10000	10	Do., B shares	7 0 0	10 0 0	9½ — 10
10000	10	Do., C shares	7 0 0	10 0 0	9½ — 10
20000	10	Do., D shares	1 0 0	10 0 0	1½ — 2
8000	5	*West Ham*	7 0 0	7 10 0	7½ — 7¼
6000	5	Do., new shares	7 0 0	7 10 0	
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 15 0	2 16 0	2 5 0	3 10 0	3 10 0
1¼ and 2-inch Socket-pipes	7 0 0	5 15 0	5 10 0	6 0 0	7 0 0
2½ and 3-inch ditto	6 10 0	5 5 0	5 0 0	5 15 0	6 10 0
4 and 5-inch ditto	6 0 0	4 15 0	4 10 0	5 5 0	6 0 0
6 inches and upwards ditto	5 15 0	4 5 0	4 0 0	5 0 0	5 15 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 5 0	5 0 0	5 10 0
Ditto, 2nd ditto, cold ditto	6 10 0	—	—	—	6 10 0
Tank-plates, ¼ thick and above	6 0 0	5 0 0	4 15 0	5 10 0	6 0 0

WROUGHT-IRON TUBING,

Subject to 50 per cent. Discount.

	2 in.	1¼ in.	1½ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 14 feet—per foot	1 8	1 1	0 10	0 7	0 5	0 4½
Ditto ditto, from 12 in. to 23¾ in.—each	3 0	2 0	1 6	1 1	0 9	0 8
Long Screws, from 12 in. upwards	4 0	2 3	2 0	1 6	1 2	0 11
Bends and Springs	4 3	2 3	1 9	1 3	0 11	0 8
Square Elbows, equal or reducing; Round Elbows, 5 per cent. extra	3 9	2 3	1 9	1 3	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 9
Crosses, ditto, equal or reducing	4 9	3 6	3 0	2 3	1 9	1 6
Iron Cocks	20 9	13 0	10 0	7 3	5 0	3 8
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4½
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	15 0	14 0	13 6	12 0	12 0	—

GAS COALS.—*Per Ton.*

	s. d.
Newcastle.—Unscreened:—	
Haswells, Nettlesworth Primrose, and South Pelaw	
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Chariaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7 0
Pearceth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	16 0
Wigan Cannel (at Liverpool)	17 0
Scotch Cannel:—	
Boghead—at Boness, 38s.; at Leith	38 8
Muirkirk	27 0
Kirkness, best (at Burntisland)	26 6
Capeldrae, 1st quality (at ditto)	25 6
Ditto, 2nd ditto (at ditto)	18 6
Cowdenbeath	12 0
Lesmahago (at Glasgow)	31 6
Ditto (at Granton)	32 6
Arniston	27 6
Wemyss, Lob	22 6
Haywood, Wilsontown (at Granton)	23 0
Pirnie, or Methill	17 0
Lothian's Cannel (f.o.b. at Leith)	26 0
Bo'ness Cannel (at Bo'ness)	19 0
Wyles' Cannel	23 6
Lochore Parrot (at Burntisland)	28 0
Lancemark (at Glasgow)	16 0
Elphinstone Tower (at Leith)	20 0
Coppa Cannel (on railsat Birkenhd.)	14 9
Ditto ditto (ditto at Connah's Quay)	14 3

FREIGHTS.

Coastwise—Newcastle.—Per Ton:—	
Chatham and Rochester	6 0
Cork	8s. 6d. to 9 0
Dover, Folkestne, & Ramsgate	6 6
Dublin	9s. 6d. to 10 0
Exeter Quay	8s. 6d. to 9 0
Ipswich	4 6
London (from Leith)	8s. 6d. to 9 0
London (Pool)	6 0
Lowestoft and Yarmouth	5 0
Portsmouth & Southampton	7s. to 7 6
Plymouth	8 0
Shoreham	7 0
Whitstable	6 0
Weymouth	7 6
Foreign.—Per Keel:—	
Barcelona	£17 0
Bordeaux	13 0
Boulogne and Calais	7 0
Cadiz	12 0
Cronstadt	—
Copenhagen	9 0
Genoa	17 6
Hamburg	—
Havre de Grace	8 15
Leghorn	17 0
Lisbon	11 0
Rotterdam	—
Stettin	—
Trieste	15 10
Venice	15 10

SUNDRIES.

Best Nstle. Fire-bks., p. 1000, £2 10s. to £2	15 0
Cliff's Fire-bks. (at Wortley), p. 1000	2 15 6
Ingham's ditto (at Wortley), p. 1000	2 15 0
Parnley Iron Co.'s Fire-bks. (at Wortley), less discount	2 17 0
Fire-clay Retorts, p. ft. run, 2s. 6d. to	0 7 6
Tough Cake Copper, p. ton	91 10 0
English Pig Lead, p. ton	19 0 0
Welsh Bar Iron (in London), p. ton	6 12 6
Foreign Spelter, p. ton	20 10 0
English Block Tin, p. ton	116 0 0
Banca, p. ton	114 0 0
Tarred Rope Yarn, p. cwt.	1 0 0

Advertisements.

FOR SALE,

SECOND-HAND STATION-METERS AND GOVERNORS,

As under, all in excellent Working Order, equal to New, guaranteed.

STATION-METERS.

5,000 Cubic Feet per hour, 8-in. Connexions.
6,000 „ „ 8-in. „
8,000 Cubic Feet per hour, 8-in. Connexions.
12,000 „ „ 10-in. „

STATION GOVERNORS for 2, 5, 6, and 12 inch Mains.

APPLY FOR FURTHER PARTICULARS TO

GEORGE RAIT, MANAGING DIRECTOR,

GAS-METER COMPANY, 238, KINGSLAND ROAD, LONDON, N.E.

C. A. S. VICKARY,

(ADMINISTRATRIX TO THE LATE JOHN VICKARY,)

GAS ENGINEER AND CONTRACTOR, IRON AND BRASS FOUNDER,

EXE ISLAND, EXETER,

Tenders her best thanks to the various Gas Companies in **England, Ireland, and Wales,** for the very liberal and kind support received by her lamented husband for the last **22 years,** during which period he erected and extended more than **200 Gas-Works.** She respectfully solicits a continuation of that support, and begs reference to the following testimonial:—

Plymouth and Stonehouse Gaslight Company.

Sir,—I have much pleasure in testifying that the 100-foot Telescope Gasholder and Cast-Iron Tank, erected by you for this Company in 1862, has given the highest satisfaction, and never required the slightest alteration or adjustment since its completion.

Mr. John Vickary. (Signed) PETER ADAMS, Chairman.

The late Mr. Vickary also erected a 100-foot Gasholder and Cast-Iron Tank at **Exeter;** an 80-foot Telescope Gasholder and Iron Tank at **Devonport;** a 90-foot at **Torquay,** &c., &c. At either of these works satisfactory references can be made.

C. A. S. V. begs particular attention to her **Improved Gas-Meters,** both **Wet and Dry,** the materials and workmanship of which are guaranteed of the very best description, and which have gained for her Meters so excellent a reputation.

RETORTS, DIP & ASCENSION PIPES, HYDRAULIC MAIN, CONDENSERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, and GASHOLDERS,

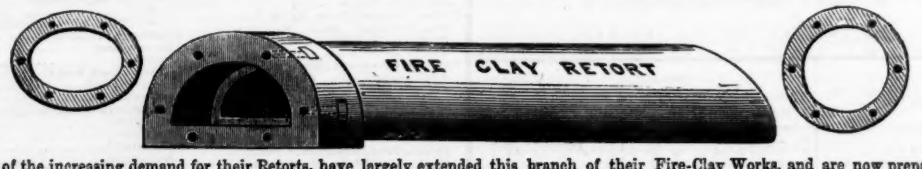
Of any size, and every description of article required in Gas-Works supplied.

Mains, Tees, Connexions, and Syphons, from 2 to 12 in., always in stock, and supplied at Scotch prices.
Clay Retorts and Fire-Goods of every description.
Chandeliers and Gas-Fittings of the most modern designs.
Iron Pipe and Fittings, Service Cocks, &c.

Plans, Specifications, and Estimates for the Erection of New Gas-Works of any size furnished.

THE FARNLEY IRON COMPANY,

FARNLEY, near LEEDS,



In consequence of the increasing demand for their Retorts, have largely extended this branch of their Fire-Clay Works, and are now prepared to execute the most important orders, either for *home* or *export*, with great punctuality.

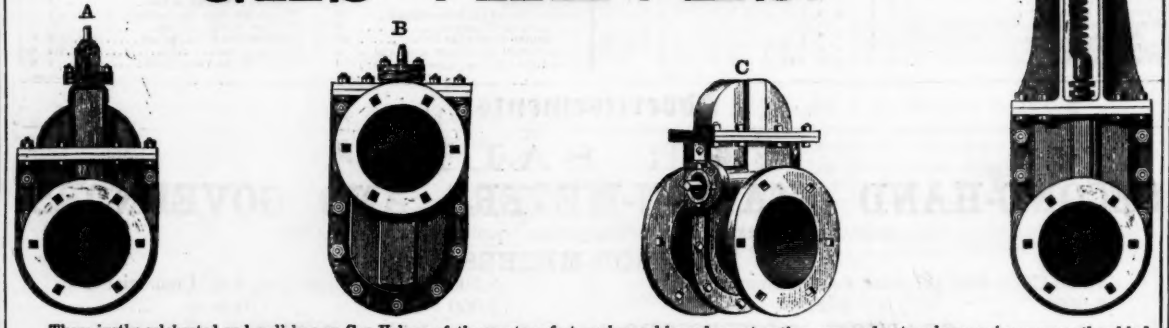
The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White, Buff and Salt-Glazed Bricks, &c., &c.

Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

C. & W. WALKERS' GAS-VALVES.



These justly celebrated and well-known Gas-Valves, of the most perfect workmanship and construction, are made at as low a price as any other kind. **A**—Above-ground Screw Gas-Valve, with improved indicator to show when open and shut, is the best Valve for Purifiers where the most perfect tightness is required, and for heavy pressure generally. **B**—Under-ground Screw Gas-Valve. **C**—Internal Rack Gas-Valve, with pinions of homogeneous metal. **D**—Ordinary Rack and Pinion Valve, with strong undamageable racks and pinions.

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE,
AND 8, FINSBURY CIRCUS, LONDON, E.C.

JOHN WRIGHT,

30, BROAD STREET, ISLINGTON, BIRMINGHAM,

MANUFACTURER OF

Registered Gas-Burners, by which £6 is saved in every £10 worth of Gas consumed;

Registered Radiating Gas-Stoves;
Registered Flat Irons;
Improved Atmospheric Gas-Stoves;
Gas Broilers, Toasters, and Roasters;
Improved Nursery Brackets;
Opal Reflectors;
Improved Smoke Consumers;
Glass Commode Knobs, &c., &c.

JOHN WRIGHT respectfully informs the trade that he supplies every article, either direct or through Merchants and Factors, at 32½ per cent. from List, except Gas-Burners, which are subject to 50 per cent. discount.

WRIGHT'S PATENT PHOTO-TELESTIKON,

Or GASLIGHT PERFECTER.

An ordinary Fishtail Burner.

A Patent Photo-Telestikon, consuming the same quantity of Gas, and giving more than twice as much light.

This Patent Burner combines all the advantages of former improved Burners, and by it the whole of the Gas is consumed, and all unpleasant smell prevented.

The tip being made in a separate piece of metal, is nicely countersunk inside, and insures a steady passage for the Gas, and also a perfectly formed flame.

The Carbon-Plate in this Burner being subject only to the cool action of the Gas, never collects any deposit, and never burns away.

It is conclusively proved that 63 per cent. more light is obtained by its use from the same quantity of Gas.

An outlay of a few pence, therefore, **will effect a saving of Six Pounds out of every Ten Pounds.**

Experience shows that a Patent Photo-Burner consuming 2 feet of Gas gives as much light as an ordinary Fishtail Burner passing (*but not consuming*) 6 feet of Gas per hour.

Considerably less Gas is consumed to produce **the large flame of the Patent Telestikon Burner than the small flame with ordinary Fishtail Burner.**

Size of Burners—Nos. 1, 2, 3, 4, 5, 6.

Price with Steel Bar, 3d. each; with Platinum Bar, 1s. each.

FIFTY PER CENT. DISCOUNT TO THE TRADE.

Patentee & Manufacturer: JOHN WRIGHT, 30, BROAD STREET, ISLINGTON, BIRMINGHAM.

WRIGHT'S IMPROVED OPAL REFLECTOR.

7-in. White Opal	6s. 6d.	Green	8s. 0d. each.
8½-in. „ „	8 6	Do.	10 6 „

WRIGHT'S ATMOSPHERIC GAS-STOVES.

No. 12—Bronzed, 1s. 6d.

No. 20—Brass Registered Stove, well finished, 8s. 6d.

6 feet Prepared India-Rubber Tube for ditto, 1s. 6d.

JOHN WRIGHT, 30, BROAD STREET, ISLINGTON, BIRMINGHAM.

GAS MANAGER & ENGINEER.

WANTED, a Gentleman qualified to undertake the

ENTIRE CHARGE

OF A

FOREIGN GAS COMPANY,

Including the carbonizing and out-door work, and the supervision of the accounts.

He will be required to give adequate security, and to produce first-class testimonials.

Salary £700 a year, a house, and £100 a year additional for every 1 per cent. dividend declared above 5 per cent.

Apply, by letter only, to No. 2010, care of Mr. W. B. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a situation as METER INSPECTOR, or as MANAGER of a small gas-work. He thoroughly understands the manufacture and distribution of gas, laying of mains and services, and fixing of meters, &c. First-class testimonials.

Address J. S., 125, High Street, TEWKESBURY.

WANTED, a situation as Manager of a small gas-work. Nineteen years excellent character.

Address T. HARVEY, 4, Marshall's Grove, WOOLWICH.

WANTED, by an Engineer, who has had good practical experience in every department of gas-works, a situation as MANAGER, where the annual consumption is from 15 to 20 million cubic feet. Unexceptionable testimonials and references.

Address No. 30, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES & CONTRACTORS.

WANTED, by the Advertiser, a situation as WORKING MANAGER. Can set clay and iron retorts, lay mains or services, and erect and repair anything belonging to the manufacture of gas. Is also a good fitter.

Address PNEUMO, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO WORKING MANAGERS OF GAS-WORKS.

WANTED, by the Tunbridge Wells Gas Company, a steady practical Man, thoroughly acquainted with the manufacture and distribution of gas, the setting and working of clay retorts, steam-engine, exhauster, &c. House, coal, and gas free. The strictest inquiry will be made as to character for sobriety, honesty, and steadiness.

Apply, stating age, whether married or single, wages expected, and when disengaged, to JOHN READ, Secretary, Gas Company's Office, Tunbridge Wells.

Tunbridge Wells, Jan. 29, 1869.

WANTED, by a thoroughly practical Man, a situation as MANAGER of a small gas-work. Understands laying mains and services, fixing meters, and can do all repairs required in a gas-work, including smith's work. Eighteen years character.

Address B. C., No. 6, Queen's Terrace, Rumsey Road, WINCHESTER.

TO GAS COMPANIES.

WANTED, by a young Man (28), a re-engagement as MANAGER of a gas-work. Annual make of gas from 5 to 20 millions. Thirteen years experience. Competent to take the entire management, including retort-setting, main and service laying, meter-taking, and keeping the accounts. Can produce first-class testimonials as to character and ability.

Address M., Post-Office, Portwood, STOCKPORT.

THE Advertiser, who has just left his situation, where he has been three years and four months, as Working Manager, requires a RE-ENGAGEMENT. Understands smithing, fitting, main-laying, and all that is required. Married. Aged 30.

Address W. ESTING, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES.

FOR SALE, a Beales Gas Exhauster, 3 ft. diameter by 2 1-6th ft. long, square out and inlets 10 in. by 10 in. Has been a few years in use. Is sold because replaced by a larger one. Coupled shaft and cog-wheel may be had with it.

Application to be made to W. ESSON, Engineer, Gas-Works, CHELTENHAM.

Jan. 1, 1869.

PURIFIERS TO BE SOLD.

A Set of Four Cast-Iron Purifiers, 10 ft. by 5 ft., with wrought-iron lids, cast-iron centre-valve, and 8-in. connexions complete. These Purifiers are to be sold in consequence of recent enlargement of the works.

For particulars address the SECRETARIES, the Gas-Works, LEAMINGTON PRIORS.

TO GASHOLDERS MAKERS.

THE Keighley Local Board of Health is prepared to receive TENDERS for the supply and erection of a TELESCOPE GASHOLDER, 100 ft. in diameter, with two lifts of 20 ft. in depth.

The drawings and specification may be seen, and further information obtained, on application to the undersigned, at the Gas-Works Offices, Lowbridge, Keighley.

Tenders must be sent in not later than Tuesday, the 16th day of February next.

The lowest or any tender not necessarily accepted.

Gas-Works Offices, Jan. 28, 1869.

THE Phœnix Gas Company of London are prepared to receive TENDERS for the supply of a STEAM VESSEL or VESSELS to bring up from the Tyne or Sunderland, and deliver direct from the Vessel alongside the Company's premises at Greenwich, Bankside, or Vauxhall, cargoes of not less than 500 tons of Coal net.

Full particulars can be obtained by application to the ENGINEER of the Company, at the Offices, 70, Bankside, SOUTHWARK, S.E.

WREXHAM GAS AND COKE COMPANY.

TO BUILDERS, CONTRACTORS, AND IRONFOUNDERS.

THE Directors of the Wrexham Gas and Coke Company are desirous of receiving TENDERS from persons willing to contract for the erection of a RETORT-HOUSE and CHIMNEY, at their works in Wrexham. The work to be executed under two contracts—viz.:

Contract No. 1 to include all the necessary brick-work for the erection of Chimney and Retort-House, and slating the latter.

Contract No. 2 to provide a wrought-iron roof for Retort-House, hydraulic main, stand-pipes, and all necessary ironwork.

Plans and specification may be seen at the Office of John Rowe, Esq., C.E., No. 1, College Street, Wrexham, on and after the 1st proximo.

Tenders to be sent to the undersigned on or before the 15th of February next.

The Directors do not bind themselves to accept the lowest or any tender.

By order of the Board,

THOMAS WALKER, Secretary.

Wrexham, Jan. 15, 1869.

TAR PURCHASED,

In Districts contiguous to the Advertisers Works.

Superior Quick-Drying Black Varnish for every description of Ironwork. Sold in barrels of about 32 gallons. Delivered free to any station in England at 1s. 2d. per gallon, cask included.

JOHN CLARKSON MAJOR,

TAR DISTILLER AND MANUFACTURING CHEMIST,

WOLVERHAMPTON.

BRANCH WORKS AT

NOTTINGHAM, CAMBRIDGE, & BRIGHTON.

FREDERICK HOPE,

Gas and Consulting Engineer,

HIGH STREET, HOUNSLOW,

Advises Gas Companies on any subject connected with the erection of gas-works and the manufacture of gas, more particularly on the following points:—REMOVAL OF NAPHTHALINE from works and mains, and preventing the deposition of the same. ECONOMY in purification, and efficacy of the same in reducing the bisulphide of carbon to a minimum. TAR FUEL on a most simple method. Plans, Specifications, and Estimates prepared on moderate terms.

JAMES HEYS ATHERTON,

PUBLIC ACCOUNTANT,

NO. 2, ATLAS BUILDINGS, SOUTH CASTLE STREET, LIVERPOOL.

Mr. Atherton begs to offer his services as Auditor, &c., having had many years experience in the management of both Gas and Water Accounts.

ANALYSES OF GAS COALS.

DR. STEVENSON MACADAM,

Honorary Member of the North British Association of Gas Engineers, is prepared to test the value of Cannel or Parrot Coals in the production of Coal Gas, and to determine the Photogenic or Illuminating Value of the Gas obtained therefrom.

The experiments are thoroughly practical, being conducted in a small gas-work, connected with accurate photometric apparatus.

LABORATORIES, SURGEON'S HALL, EDINBURGH.

THOMAS LAMBERT & SONS,

SHORT STREET, LAMBETH, LONDON,

PATENTEES OF THE

HIGH-PRESSURE EQUILIBRIUM BALL VALVES AND DIAPHRAGM BIB & STOP VALVES,

MANUFACTURE EVERY DESCRIPTION OF

GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.;

WROUGHT-IRON

WELDED TUBE AND FITTINGS,

BLACK AND GALVANIZED;

BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING;

STOCKS, TAPS, AND DIES,

And Every Description of Gas-Fitters Tools;

CAST-IRON GAS-MAIN COCKS,

WITH PATENT METAL PLUGS;

GAS SLIDE AND SLUICE VALVES;

CARTER'S SAFETY GAS-VALVES;

GAS-STOVES, REGULATORS, BURNERS, &c.

Large Pattern-Book and Price List of Gas-Fittings, price 7s. 6d., supplied on application.

Mr. H. GORE,

CONSULTING GAS ENGINEER,

20, ALFRED PLACE, BEDFORD SQUARE, LONDON, W.C.

CATHELS'S Patent Dry District GOVERNOR is the only perfect self-acting contrivance for regulating the pressures in the higher levels of a district.

CATHELS'S Patent Four-way Disc GAS-VALVE—ONE OF WHICH SERVES AS THREE ORDINARY VALVES—is the best Valve for gas-works.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS'S Patent Ribbed Gas Main- PIPES cost but about 1d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.

Apply to Messrs. BEGGS & SON, 37, Southampton Street, Strand, LONDON.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, Ghent.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications, addressed to J. SUGG and Co., GHENT, will receive immediate attention.

ROBERT MACLAREN and CO., EGLINTON FOUNDRY, GLASGOW, Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

TO GAS ENGINEERS AND FITTERS.

Every Description of

GAS LANTERNS & REFLECTOR LAMPS

For Shop Windows kept in Stock.

W. DAVIS, 17, Wells Street, Oxford Street, LONDON, W.

Established 1820.

NINETEEN YEARS PRACTICAL EXPERIENCE.

EDWIN BENTLEY,

RETORT SETTER,

29, LOWER HOPE STREET, HALIFAX,

YORKSHIRE.

Fire-Clay and Iron Retorts, Double and Single Grooved Brick Retorts, of every description.

Bentley's Improved D Brick Segment Retorts, 5 or 3 in one bed.

Testimonials and references on application.

W. J. SIMMONDS,

Retort and Boiler Setter and Contractor for Gas-Works in general,

7B, SOUTH STREET, NEW NORTH ROAD,

ISLINGTON, LONDON, N.

Upwards of 16 years Retort Setter to the Chartered Gas Company, Brick Lane and Curtain Road Stations.

Materials supplied on reasonable terms if required, or labour only.

No connexion with any other Retort Setter.

N.B.—Orders to be addressed as above.

F. SIMMONDS, Senr.,

221, KINGSLAND ROAD,

RETORT & BOILER SETTER

For the Chartered Gaslight Company, Brick Lane and Curtain Road Stations, and numerous Gaslight Companies, London and Provincial.

NO CONNEXION WITH ANY OTHER RETORT SETTER.

Estimates given with or without materials.

HARRIS AND PEARSON,

STOURBRIDGE.

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY.

MANUFACTURERS OF

FIRE-BRICKS, GAS-RETORTS, AND FIRE-CLAY GOODS

OF EVERY DESCRIPTION.

Orders of any magnitude, for home and exportation, executed with all possible despatch.

N.B.—A quantity of Retorts in stock.

Circulars, 15 in. and 16 in. Ovals, 20 in. by 14 in.

D's, 15×13, 16×12, 18×14, 20×16, 21×14, 24×14.

B. CARPENTER'S

IMPROVED

WOOD SIEVES FOR GAS PURIFIERS.

WORKS:

14, JOHN STREET, PENTONVILLE ROAD,

LONDON, N.

The above Sieves are used by the principal Gas Companies in London and the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

EDWARD COCKEY & SONS,

IRON-WORKS, FROME SELWOOD,

PATENT GAS-VALVES.

A PRIZE MEDAL

WAS AWARDED TO THE PATENTEES AT THE INTERNATIONAL EXHIBITION OF 1862.

These Valves are formed of two cylinders, working one on the other horizontally, having their faces ground perfectly gas-tight.

They are adapted either as central valves, for two, three, or four purifiers—as bye-passes—or as inlet and outlet-valves for gasholders.

They have been fixed in some of the most important Gas-Works in the Kingdom, for more than eight years. Considerably over two hundred of them are now in use, and the most satisfactory reports of their advantages continue to be received. They are simple in construction, and not liable to get out of repair, and if in course of time the faces should leak, they can be easily re-ground and made as tight as ever, without removal from their positions. Each Valve is fitted with an index, which shows to the person in charge of the Works in what direction the gas is passing.

Frome, January 20, 1866.

DRY GAS-METERS IN CAST-IRON CASES,

MANUFACTURED BY

WILLIAM AND BENJAMIN COWAN,

(ESTABLISHED 1827,)

BUCCLEUCH STREET WORKS, EDINBURGH,

Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known.

SOLE MANUFACTURERS OF

ESSON'S PATENT COMPENSATING GAS-METERS.

COWAN'S PATENT SIDE-VALVE GAS-METERS.

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

ORLANDO BROTHERS,

MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

BEST AND HOLDEN'S

PATENTS FOR CHARGING AND DRAWING GAS-RETORTS,

WITH CHAMBERS FOR MOUTHS,

REQUIRING NO LUTING.

Gas Engineers are solicited to examine into the merits of this invention before erecting new or altering old retort-houses. It may be seen in action at the Alliance Gas Company's Works, Dublin, where its utility and economy will be clearly demonstrated. Although the saving in labour will be considerable, and quickly return any outlay of capital, there are other and important features strongly recommending its adoption at all gas-works, and which a gas engineer upon examination will at once appreciate.

The Directors of the Alliance Gas Company have kindly consented to give every facility to gentlemen desirous of seeing the invention in operation. Parties, therefore, about to visit Dublin will be so good as to send us their card, and we will furnish them with letters of introduction.

Drawings, &c., may be seen at our Office, and all details explained.

JOHN CHISHOLM, SON, & CO., 44, MARK LANE, E.C.

ECONOMY IN GAS PURIFICATION.

Mc DOUGALLS'

HYDRATED PEROXIDE OF IRON.

This Oxide is now well known, and has gained at a number of the largest gas-works at home and abroad a decided preference for efficiency and durability. It is free from any mixture of sawdust or other material, every particle being available for use, thus causing the Purifiers to work double the time before it requires renewing, and saves one-third the cost of labour in charging them. It readily takes up sulphur, revivifies rapidly, and lasts longer than any other Oxide in the market. Prices on application to—

McDOUGALL BROTHERS, Manufacturing Chemists,

LONDON—11, Arthur Street West, London Bridge, E.C.; MANCHESTER—Riga Street, Shudehill.

CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:—

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz—

Yield of gas	10,416 cubic feet.
Illuminating power . . .	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas.	10,080 cubic feet.
Illuminating power . . .	14·41 sperm candles.
Yield of Coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL. We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

SWANWICK CANNEL COAL. Illuminating power 23·98 candles; yield large, and coke good.

Analyses by W. Valentin, Esq., of the Royal College of Chemistry, London, and William Fiddes, Esq., F.C.S., Gas-Works, Bristol, with price and terms, forwarded on application to H. BOAM, Head Office, 1, Darwin Terrace, DERBY.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,
COPPA COLLIERY, MOLD,
Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THOMAS EDINGTON & SONS,
PHŒNIX IRON-WORKS,
GLASGOW,
Manufacturers of all kinds of
GAS AND WATER PIPES,
Branches, Bends, Water-Traps, Tank-Plates, Valves, and general Castings. Also
RAILWAY CHAIRS & SLEEPERS,
AND
GRIFFIN'S PATENT PERMANENT WAY.
London Office, 63, Old Broad Street.

OXIDE OF IRON,
We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
FRANCIS RITCHIE & SONS,
BELFAST.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 101, Cannon Street, E.C.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST-IRON GIRDER

DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

HENRY F. WILLEY,
(Manager for the late Mr. Vickary, of Exeter, 15 years,)
GAS ENGINEER AND CONTRACTOR.
WORKS: BARTHOLOMEW STREET, EXETER

Improved Wet and Dry Meters. Gas Apparatus and Gas-Fittings Manufacturer.
Contractor for the Erection of Gas-Works, Gasholders, Station-Meters, Governors, and every article and apparatus appertaining to Gas-Works.

F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, & LUSTRES FOR GAS & CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE & ORMOLU. MODERATOR LAMPS.

ROBERT DEMPSTER,
Gas Engineer and Contractor, Rose Mount Foundry, Elland, near Halifax.

R. D. recommends his Fire-Brick Retorts to Engineers and Managers of Gas Companies; they last from 10 to 12 years.

Iron and Fire-Clay Retorts.
Annular and Pipe Condensers.
Scrubbers and Purifiers, all sizes.
Steam-Engines and Exhausters.
Hydraulic Centre-Valves.
Station-Meters and Governors.
Photometers & Pressure-Gauges.
Lamp-posts and Brackets.
Cast-Iron Mains and Syphons.
Wrought-Iron Tubes, Water Tanks.
Wrought-Iron & Cast-Iron Roofs.
Gasholders, Single-Lift or Telescopic.
Gas Castings of every description.
Retort Setters and Fitters sent to all parts of the country.
Wood Sieves for Purifiers.

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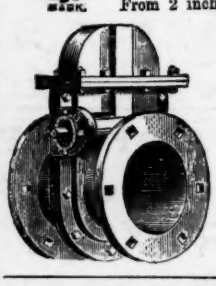

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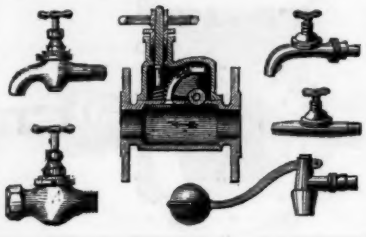

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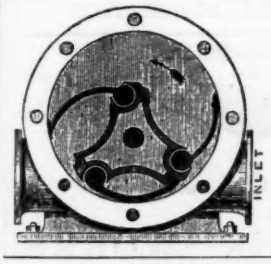

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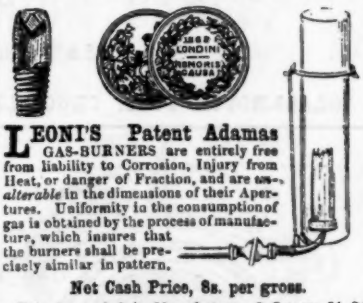

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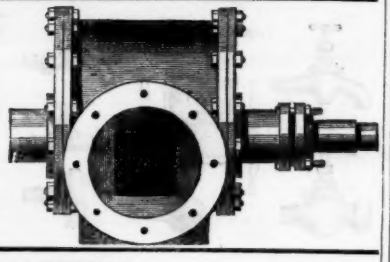

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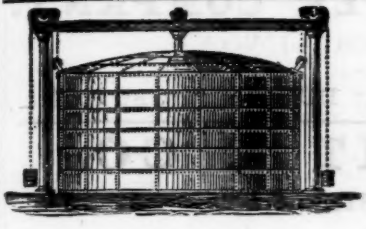

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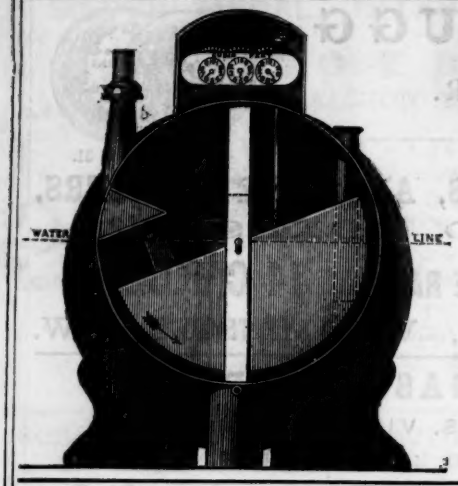

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